

APPENDIX F

VENTILATION RATE AND AIR MIXING STUDIES OF THE LARGE-SCALE CHAMBER FACILITY

OBJECTIVES

The objectives of these experiments were to: 1) establish and measure the three fixed air change rates for each of the two large-scale chamber compartments; 2) establish and measure the air velocities in the compartments using small fans; 3) measure the quality of air mixing within each compartment at the two lower fixed air change rates; and 4) measure the air leakage between each compartment and the building and between the two compartments.

DESCRIPTION OF CHAMBER FACILITY

The chamber facility is housed in a small building. This building is equipped with thermostatic controls and a heat-pump system for heating and cooling. This system is capable of maintaining the building temperature within approximately $\pm 3^\circ\text{C}$ of the set point under most climatic conditions.

Chamber compartments A and B were designed and constructed to simulate conditions for a small room in a typical residence. The interior dimensions of each compartment are 2.26 m wide by 4.62 m long with a 2.44-m high ceiling, yielding a volume of 25.5 m³. The walls and ceiling are finished with gypsum board. The seams between boards were taped and topped with joint compound. The finished gypsum board was painted with a "no VOC" primer and flat latex paint combination. The plywood floor was covered with thin aluminum plates with overlapping joints. The plates were screwed down to the floor and the joints were sealed with aluminized tape. Each compartment has a single, unfinished, composite-wood slab door 0.91 m wide by 2.13 m high. The door is weather-stripped on all edges to reduce air leakage. During an experiment, the gaps around the door are sealed with duct tape. There are no windows.

Ventilation air for the chamber compartments is supplied from the exterior of the building through a 15-cm diameter aluminum duct. This air is filtered for gaseous contaminants by passing through a sheet metal box containing a 5-cm thick horizontal bed of activated charcoal with surface dimensions of 0.61 by 0.61 m. The filter box has two exits, each leading to one compartment. The components for each of these systems are identical. An in-line centrifugal blower is attached to the filter box. Downstream of the blower is a manifold leading to three different sized ducts. The internal duct diameters are 3.0 cm, 5.1 cm and 7.6 cm. They are used to provide chamber compartment air change rates of 0.5, 2 and 5 h⁻¹, respectively. Manual valves on the manifold are used to select the desired duct. The ducts are 1.83 m long. A pitot tube (Dwyer Instruments, Inc.) is installed 0.46 m from the outlet end of each duct to monitor the air velocity pressure in the pipe. A manual gate valve is installed downstream of the pitot tube for the 3.0-cm and 5.1-cm diameter ducts. This valve is used to set the desired air flow rate. The air then directly enters the compartment 20 cm above the floor at a long end of the compartment. A cap is placed on the outlet of the 7.6-cm duct in the compartment and drilled with holes which sets the desired air flow rate. All the components of the duct system downstream of the blower are ABS and PVC plastic. They were washed with methanol prior to assembly. All joints are pressed tight and held with screws. No adhesives or sealants were used to assemble the system.

The chamber facility is equipped with a system to add water vapor to the ventilation supply air upstream of the filter box. This system is used to increase the humidity of the supply air when it falls below a minimum value of 40% relative humidity at room temperature. The components consist of: a humidity probe positioned in the filter box; a water reservoir; a variable speed peristaltic metering pump with electronic controls; a specially-fabricated aluminum duct

section heated with a laboratory hot plate; and a water overflow drain. The data system measures the humidity in the filter box and uses a proportional-control algorithm to set the speed of the water-metering pump.

Air exits each compartment on the same wall that air enters the compartment. The center of the outlet is located 38 cm from the ceiling, about 2.2 m diagonally across from the air inlet. The dimensions of the outlet are 15 cm by 25 cm. Exterior to the compartment, the exhaust is fitted with a damper, which is manually adjusted according to the set air change rate. The exhaust duct is a 6-m section of 15-cm diameter flexible tubing leading to a vent on the roof of the building.

Each compartment is fitted with six 7.6-cm diameter axial fans to provide adequate air mixing. These fans are attached to vertically aligned removable metal poles. There are two fans spaced equally along each long wall and one fan located in the middle of each short wall. The fan heights alternate between 0.81 and 1.62 m from the floor. The fans are positioned 30 - 38 cm from a wall and are aligned so that they move air parallel to the wall. They all move air in the same direction. The fan speeds are controlled with a variable transformer to achieve the desired air velocity near the floor of the compartment.

Air is sampled from the mid-point of each compartment. The inlet of a 0.4-cm I.D. stainless-steel tube is positioned 1.5 m above the floor at the mid point. This tube runs directly to the exterior of the chamber and is connected to a stainless-steel sampling manifold with three ports to allow for the simultaneous collection of duplicate samples for volatile organic compounds and a single sample for aldehydes. Air is continuously pulled through the sampling tube at a rate of 1 L min⁻¹ throughout an entire experiment. Sampling flow rates are regulated with electronic mass flow controllers (Model FC 280, Tylan General) connected to vacuum pumps. These devices operate continuously at the established flow rates. The inlets of the sampling lines leading to the mass flow controllers are connected to electronically actuated three-way solenoid valves. The sampling devices are connected to the sampling manifold and to the valves. For sampling, each valve is switched by the data system from the open position to the position connected to the sampling device. At the end of a set time period, the data system switches the valve back to the open position and sampling is terminated. In some cases, the samples are manually collected during the period in which the valves are held in the in-line position.

The instrumentation for each compartment consists of: 1) a pressure transducer (Model 239, Setra Systems, Inc.) to measure the velocity pressure for the selected pitot tube; 2) a combined RTD temperature and relative humidity probe (Model HMD30YB, Vaisala) positioned at the midpoint of the compartment 1.5 m above the floor; 3) four Type T thermocouples to measure floor temperature and air temperature stratification; and 4) an air velocity transducer (Model 8470-5AM-V-STD-NC, TSI, Inc.) with a range of 0 to 50 cm sec⁻¹ to monitor air velocity 5 cm above the floor. The voltage outputs from these devices are measured at one-minute intervals and averaged and recorded at five-minute intervals with a PC-based data system (Series 500, Keithly/Metrabyte) and data acquisition software (Labtech Notebook, Version 7; Laboratory Technologies, Corp.).

METHODS

The tracer gas employed for these experiments was sulfur hexafluoride (SF₆). A gas cylinder containing a one-percent mixture of SF₆ in air was used as the supply. The flow rate of the SF₆ mixture into the chamber system was regulated with a calibrated electronic mass flow controller. Four peristaltic pumps were used to draw air for the analysis of SF₆ from the chamber system and the building into a computer-controlled multi-port valve. This allowed four separate locations to be sequentially analyzed with a one-minute interval between successive samples. A gas chromatograph equipped with an automated gas sample valve and an electron capture detector was used for the analysis. This system was calibrated on each day of analysis using dilutions of certified gas mixtures of SF₆ and air.

To set and measure the flow rate of air entering a compartment through a supply duct, the one-percent SF₆ gas mixture was metered at a constant rate into the inlet of the selected duct just downstream of the compartment supply manifold. The SF₆ concentration was measured in the air in the duct just as it entered the compartment. For the 3.0-cm and 5.1-cm diameter ducts, the gate valve was adjusted until the supply SF₆ concentration matched the concentration for the desired air flow rate found using,

$$C_A^0 = \frac{C_{SF6} \cdot Q_{SF6}}{\lambda_A V_A} \quad (1)$$

Where C_A^0 is the expected concentration in the supply of compartment A with a volume, V_A , and an air exchange rate of λ_A . The SF₆ from the tank has a concentration, C_{SF6} , and is supplied with a mass flow controller at a volumetric flowrate Q_{SF6} . For the 7.6-cm diameter duct, holes were drilled in the cap on the duct outlet until the calculated concentration was reached. When the desired flow rate was established, the velocity pressure drop for the corresponding pitot tube was recorded in volts with the system pressure transducer and in inches of water with a portable electronic pressure meter.

A residence time distribution experiment was performed for each compartment at each fixed air change rate as described in ASTM D 5116-90 (1990). The objectives of this procedure were to identify any bypassing of air between the air inlet and exhaust or any significant air leakage and to quantify the quality of air mixing in the compartment. First, the compartment was ventilated at the maximum rate until the SF₆ concentration in the compartment was near the limit of detection. Then, an experiment was initiated starting with the lowest air change rate. The tracer gas was introduced as described above. The time that the SF₆ was first introduced into the supply duct established the initial time for the experiment. The SF₆ concentration was measured at four locations: 1) clean supply air at the filter box; 2) the inlet air in the duct just as it entered the compartment; 3) the mid point of the compartment; and 4) the air exhaust. Since there was a one-minute interval between successive samples, the SF₆ concentration at each location was measured every four minutes. The experiment was continued until steady state SF₆ concentrations were achieved in the compartment and the exhaust. This experiment was repeated for the other two fixed air change rates. For each experiment, the effective volume, V_{eff} , was found using,

$$V_{eff} = \frac{V_A \cdot \lambda_A}{\lambda_A^{RTD}} \quad (2)$$

Where, the air exchange rate based on the residence time distribution, λ_A^{RTD} , was found by fitting the tracer concentration data to,

$$\frac{C_A}{C_A^0} = 1 - \exp(-\lambda_A^{RTD} \cdot t) \quad (3)$$

Where, C_A is the tracer concentration in compartment A, C_A^0 is the tracer concentration in the supply, and the initial concentration of the tracer is zero. The effective volume was then compared to the actual volume.

In order to measure the rate of air leakage from a compartment to the building, the pressure drop between the compartment and the building was first measured at the 0.5 and 2 h⁻¹ air change rates with the compartment operating normally. Then, the exhaust was sealed by taping a flat plate over the opening in the compartment. Inlet air flow was established in the smallest diameter duct, and the control valve was adjusted to achieve a pressure drop between the compartment and the building that matched the measured pressure drop for normal operation

at either the low or intermediate air change rates. This inlet air flowrate was, thus, a measure of the leakage rate since the exhaust was sealed. A 0.5-L volume of the one-percent air mixture of SF₆ was quickly introduced into the compartment at the mid point, and the concentration of SF₆ in the compartment over time was fit to the following equation to quantify the decay or leakage rate.

$$\frac{C_A}{C_A^i} = \exp(-\lambda_L^A \cdot t) \quad (4)$$

Where, C_A^i is the initial tracer concentration, λ_L^A is the air leakage rate from compartment A to the building, and t is time.

A separate experiment was conducted to determine the air leakage rate between the two compartments. One compartment was operated at the 2 h⁻¹ air change rate while the second compartment was operated at 0.5 h⁻¹. Thus, there was a pressure differential established between the two compartments. Tracer gas was supplied to the first compartment and measured in both compartments over time. The experiment was run until near steady-state SF₆ concentrations were achieved in the second compartment. The data were applied to a simple two-chamber mass-balance model. The first chamber was modeled as having one air supply and two exhausts, the standard exhaust outlet and the leakage to the second compartment operating at lower pressure. The leakage rate was found using the following equation.

$$\lambda_L^{A \rightarrow B} = \frac{\lambda_B (C_B - C_B^0)}{(C_A^0 - C_B)} \quad (5)$$

Where, C_B is the tracer concentration in chamber B, C_A^0 and C_B^0 are the supply SF₆ concentrations for compartments A and B, and λ_B is the air exchange rate for compartment B. $\lambda_L^{A \rightarrow B}$ is the inter-compartment leakage rate defined as Q_L/V_A , where Q_L is the inter-compartment volumetric flowrate. Equation (5) is valid at steady state when $C_A \approx C_A^0$.

Air velocities near the floor of each compartment were mapped with the compartment operating at 0.5 h⁻¹ and with the mixing fans operating. The floor of each compartment was marked off into a three by five equal-area grid. The sensor tip of the air velocity transducer was successively placed 5 cm above the floor at each of the eight grid intersections. The air velocity at each point was recorded with the data system. Air velocities were also measured at the center point of each of the four compartment walls (5 cm away from the wall) under the same conditions.

RESULTS AND DISCUSSION

The results of the measurements of the three fixed air change rates for the two chamber compartments are presented in Table F-1. The established air change rates were within plus or minus four percent of the desired values.

The results of the residence time distribution experiments are presented in Table F-2. For the low and intermediate air change rates in each compartment, the deviation of the effective compartment volume from the actual volume was close to ten percent. At the 5.0 h⁻¹ air change rate, the deviation was close to 20 percent. ASTM D 5116-90 (1990) suggests that a deviation of about ten percent or less is acceptable; however, precise quantitative guidance on how complete the mixing must be is not yet available. In all cases but one, the effective volume was greater than the actual volume. This implies that some of the supply air was escaping through a leak before it became well mixed with the air in the compartment. For one experiment (Compartment A at the 2.0 h⁻¹ air change rate), the effective volume was smaller indicating that a small amount of supply air was bypassing to the exhaust.

The results of the leakage rate experiments are presented in Table F-3. Six to 13 percent of the air in a compartment leaked out of the compartment to the building at the 0.5 and 2 h⁻¹ air change rates. The inter-compartment leakage experiment indicated that the air leakage between compartments operating at 0.5 and 2 h⁻¹ rates was less than one percent of 0.5 h⁻¹.

The air velocities measured in the two compartments operating at 0.5 h^{-1} are presented in Table F-4. The average air velocity (± 1 standard deviation) 5 cm above the floor in compartment A was $11 \pm 4 \text{ cm sec}^{-1}$. The average air velocity 5 cm above the floor in compartment B was $9 \pm 4 \text{ cm sec}^{-1}$. The air velocities measured at the walls averaged 20 cm sec^{-1} for each compartment.

REFERENCE

ASTM. 1990. *ASTM Standard D 5116-90, Standard Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions From Indoor Materials/Products*, American Society for Testing and Materials, Philadelphia, PA.

List of Tables

	<u>Page</u>
Table F-1. Measured fixed air change rates for chamber compartments A and B.	334
Table F-2. Air residence time distributions for chamber compartments A and B.	334
Table F-3. Air leakage from chamber compartments A and B to the building at the 0.5 and 2.0 h^{-1} air change rates.	335
Table F-4. Summary of the floor and wall air velocities measured in chamber compartments A and B at the 0.5 h^{-1} air change rate.	335

Table F-1. Measured fixed air change rates for chamber compartments A and B. The volume of each compartment is 25.5 m³.

Parameter	Values, Compartment A			Values, Compartment B		
Expected air change rate (h ⁻¹)	0.5	2.0	5.0	0.5	2.0	5.0
Expected inlet air flow rate (L min ⁻¹)	212	850	2,120	212	850	2,120
1% SF ₆ flow rate (mL min ⁻¹)	3.35	13.4	33.5	3.35	13.4	33.5
Velocity pressure (Setra Volts)	0.72	1.06	1.36	0.80	1.23	1.42
Average SF ₆ compartment conc. (ppb) ± 1 std. dev.	157 ± 2	160 ± 2	163 ± 2	161 ± 2	167 ± 3	155 ± 1
Measured air change rate (h ⁻¹)	0.50 ± 0.01	2.0 ± 0.1	4.8 ± 0.1	0.49 ± 0.01	1.9 ± 0.1	5.1 ± 0.1

Table F-2. Air residence time distributions for chamber compartments A and B. The volume of each compartment is 25.5 m³.

Parameter	Values, Compartment A			Values, Compartment B		
Expected air change rate (h ⁻¹)	0.5	2.0	5.0	0.5	2.0	5.0
Average SF ₆ conc. (ppb)	157	177	167	173	161	149
Measured air change rate (h ⁻¹)	0.46	2.04	3.95	0.43	1.80	4.50
Effective volume (m ³)	28.1	22.6	31.0	27.3	28.1	30.5
Deviation from actual volume (%)	+10	-11	+21	+7	+10	+20

Table F-3. Air leakage from chamber compartments A and B to the building at the 0.5 and 2.0 h⁻¹ air change rates.

Parameter	Values, Compartment A		Values, Compartment B	
	0.5	2.0	0.5	2.0
Air change rate (h ⁻¹)	0.5	2.0	0.5	2.0
Pressure differential (Pa)	1.0	3.0	1.0	3.0
Leakage rate (h ⁻¹)	0.05	0.11	0.07	0.16
Leakage rate (%)	10	6	13	9

Table F-4. Summary of the floor and wall air velocities measured in chamber compartments A and B at the 0.5 h⁻¹ air change rate. Velocities were measured 5 cm from surfaces.

Parameter	Air Velocity, cm sec ⁻¹	
	Compartment A	Compartment B
Floor		
Number of points	8	8
Range	6 - 18	2 - 13
Average (± 1 std. dev.)	11 \pm 4	9 \pm 4
Walls (mid point)		
Number of points	4	4
Range	11 - 32	14 - 23
Average (± 1 std. dev.)	20 \pm 11	20 \pm 4

(Page is intentionally blank)

APPENDIX G

PROCEDURES USED FOR EXPOSURE REDUCTION EXPERIMENTS CONDUCTED IN THE LARGE-SCALE CHAMBER FACILITY

GENERAL PROCEDURES

These experiments were designed to measure the concentrations and emission rates of the target compounds under simulated residential indoor environmental conditions. The chamber facility is described in detail in Appendix F. The walls and ceilings of the two chamber compartments were gypsum board painted with flat latex paint, which is the most typical residential wall treatment. The floors were covered with carpet or sheet vinyl flooring. Furnishings were also included as these may act as additional sinks for the deposition and re-emission for compounds that are emitted by the source assemblies. A set of eight identical chairs was purchased for this purpose. These chairs were fully upholstered, medium-sized, arm chairs. They had previously been used in a hotel. The fabric was a fleecy synthetic material. Drapery from the same source was also purchased. The fabric appeared to be cotton or a cotton blend. The material was cut down into panels with dimensions of 1.5 by 2.1 m. Two chairs and one drapery panel were used for each experiment. The chairs and drapery panels were alternated among the experiments and were aired out between uses.

The chamber compartments were thoroughly ventilated between experiments in order to reduce the background concentrations of volatile organic compounds (VOCs) and aldehydes. Typically, this was done for more than two weeks. Background concentrations of VOCs and aldehydes were monitored occasionally during the airing-out periods between experiments. Just prior to initiating an experiment, the compartment was operated at a ventilation rate of 0.5 h⁻¹ for two or more days. For this background measurement period, the compartment was furnished with two chairs and a single drapery panel hung on a wire at the short wall of the compartment opposite the supply air inlet and the exhaust. Each compartment was fitted with six, speed-controlled, 7.6-cm diameter axial fans to provide adequate air mixing within the compartment. The placement of these fans is described in Appendix F. For experiments with the latex paint combination, painting substrates consisting of textured gypsum wall board and plywood panels and wall-to-wall carpeting were installed prior to the background measurement period. At the end of this period, air samples for VOCs and aldehydes were collected from the compartment and from the supply air downstream of the charcoal filter.

In preparation for the installation of the source assembly for each experiment, the supply air flow rate was set to provide a ventilation rate of 2.0 or 5.0 h⁻¹ as required. The compartment exhaust damper was adjusted accordingly, and the tubing connections for the pressure transducer were manually moved to the selected pitot tube. The technicians then entered the compartment and removed the chairs, the drapery panel, and the sampling line. For experiments with floor coverings, they also removed the air mixing fans. The technicians installed the source assemblies following the protocols described below. They re-install the fans, the temperature and humidity probe, the thermocouples, and the sampling line and exited the compartment. The data acquisition and sample valve control program was then terminated and re-started. This established the initial time for the experiment.

The first set of air samples was collected from the compartment and the supply air at an average elapsed time of one hour. At 2-h elapsed time, the technicians re-entered the compartment and installed the two chairs, the drapery panel and an air velocity transducer. They exited the compartment, and the door was taped closed. The door was not opened and the compartment was not re-entered after this time. The compartment ventilation rate was reduced to either 0.5 or 2.0 h⁻¹; the exhaust damper was adjusted; and the tubing connections for the pressure transducer were moved.

Additional air samples were collected from the compartment and the supply air at average elapsed times of three and six hours on the first day of the experiment. Subsequently, samples were collected daily for the next nine days at 24-h intervals from the time the experiment was initiated. The final set of air samples was collected on day fourteen of the experiment at 336-h elapsed time. Replicate samples for VOCs were collected on at least two sampling events during an experiment.

For experiments with elevated ventilation, the compartment was operated at a ventilation rate of 2.0 h^{-1} for the first 72 hours following the installation of the source assembly. Then, the ventilation rate was reduced to 0.5 h^{-1} ; the exhaust damper was adjusted; and the tubing connections for the pressure transducer were moved.

Prior to each experiment, the calibrations of the mass-flow controllers used to regulate the air sampling rates were checked with a flow calibrator.

The environmental and other data were recorded throughout an experimental period and the sampling values were controlled using a computer-based data acquisition and control system. The sensors and the data acquisition and control system are described in more detail in Appendix F. The experimental data consisted of: probe RTD temperature 1.5 m from floor at the midpoint of the compartment; probe relative humidity from the same location; four thermocouple temperatures in the compartment (one on the floor, one 30 cm from the ceiling at the end of the compartment nearest the supply air inlet, one 30 cm from floor at the opposite end of the compartment, and one 1.2 m above the floor near the midpoint of interior wall); air velocity 5-cm above the floor; flow velocity pressure; supply air relative humidity; several thermocouple temperatures in the building; mass-flow controller flow rates; sampling valve positions; elapsed time and clock time. The data were recorded at 5-minute intervals.

LATEX PAINT COMBINATION

The substrate used for the application of the flat latex paint consisted of five panels of 1-cm thick, unfinished, gypsum wall board each with surface dimensions of 1.22 by 2.44 m yielding a total painting surface area of 14.9 m^2 . More than one month prior to the experiments with paint, the exposed surfaces of all of the panels were textured using a professional texturing gun and commercial texturing compound. The textured surface that was applied was typical of many residential wall board installations.

The substrate used for the application of the semi-gloss latex paint consisted of two 1.3-cm thick panels of smooth-surface plywood each with surface dimensions of 0.61 by 0.91 m yielding a total painting surface area of 1.1 m^2 .

The gypsum board and plywood panels were installed in the compartment two or more days prior to initiating an experiment. The gypsum board panels were installed over the painted walls of the compartment and held in place with screws. The panels extended from the floor to the ceiling. Three panels were installed along the long interior wall of the compartment. The edges of these panels were butted against each other. The remaining panels were installed on each side of the door on the opposite long wall of the compartment. The plywood panels were hung on the short walls with one panel at each end of the compartment. The floor of the chamber was swept clean after installing the panels.

Next, the floor of the compartment was completely carpeted. The carpet used for all of these experiments with paints was an action back, tufted level loop, 100 percent olefin fiber material. The carpet was obtained from a local retailer and had been in the retailer's warehouse stock for an extended period prior to the purchase. The carpet was installed directly over the aluminum-clad floor without a carpet cushion. It was held in place with tack strips positioned around the inside perimeter of the compartment. No seam tape or adhesives were used in the installation.

Following the installation of substrate panels and the carpet, the two chairs, the drapery panel, the air mixing fans, the temperature and humidity probe, and the sampling line were installed. Then the 48-h background measurement period was initiated.

The paints used in the experiments were purchased from a local retailer. They were all obtained in 3.78-L containers. The semi-gloss latex paint was mixed and split into new 0.95-L paint containers following purchase since a relatively small amount of this paint was used in each experiment. Immediately prior to use, each paint container was thoroughly mixed by shaking and stirring.

The paints were applied using typical painting tools. The latex primer sealer was applied to the gypsum board panels by roller using a new 23-cm wide roller cover with a 0.9-cm nap. A brush was used to apply the primer to the upper and lower borders of the gypsum panels and to the two plywood panels. The flat latex paint was applied to the primed gypsum panels using a new roller cover of the same type. Another brush was used to apply the flat latex paint to the upper and lower borders of the gypsum panels. A third brush was used to apply the semi-gloss paint to the primed plywood panels. New plastic liners were used to contain the paints in the roller trays. Plastic drop cloths were used to collect any paint spilled during the painting process. All paint containers, tools and drop cloths were weighed immediately prior to and following an experiment. These weights were used to calculate the masses of the three paints that were applied to the panels.

The latex primer sealer and the flat latex paint were applied to the gypsum board panels by roller using a standardized procedure that followed recommended industry practice. The roller was loaded with paint, and the paint was applied to an approximately 0.6 by 0.1.2 m area following an "N" pattern. The pattern was filled in by running the roller horizontally over the area and was then smoothed out with vertical strokes. This procedure was repeated until the entire surface area was painted.

For each of these experiments, the latex primer sealer was applied first. Two technicians entered the compartment with the primer, painting tools and a work light. The door was closed and remained closed during the painting operation. It took approximately 25 minutes to apply the primer. At the end of this period, the technicians exited the compartment with the remaining paint and the painting tools. The primer was allowed to dry for one hour as recommended by the manufacturer. Exactly one hour after initially entering the compartment, the technicians re-entered with the flat and semi-gloss latex paints and painting materials. They applied these paints following the same sequence as used for the primer. It took approximately another 20 - 25 minutes to apply the finish paints. The remaining paint and painting tools were passed out of the compartment. The temperature and humidity probe, the thermocouples, and the sampling line were installed and positioned. The technicians then exited the chamber with the work light. This established the beginning of the 336-h experimental period. At 2-h elapsed time, the technicians re-entered the compartment and installed the two chairs, the drapery panel, and the air velocity transducer.

For the paint experiment with added air mixing and additional ventilation, two oscillating room fans, 30 cm in diameter, were installed in the compartment at 2-h elapsed time when the two chairs and the drapery panel were also installed. The fans were placed on a metal hospital cart in the approximate middle of the compartment. The axial centers of the fans were 1.1 m above the floor. The fans were positioned and operated so that they oscillated along the long walls of the compartment and moved air approximately perpendicular to these walls. The fans were continuously operated at their maximum speed setting until 72-h elapsed time when they were switched off externally to the compartment. The fans remained in the compartment for the duration of the experiment.

At the end of each experiment, the painted gypsum board, the plywood panels and the carpet were removed from the compartment, and the compartment was ventilated at a high air change rate.

CARPET ASSEMBLY

The carpet used for these experiments was an action back, tufted textured loop, 100 percent olefin fiber material. This carpet was purchased through a contract flooring dealer. The dealer was able to obtain material that had been manufactured approximately one week prior to its delivery to the dealer. Upon delivery, the large roll was cut into the approximate sizes required for the experiments. For each experiment, there were three sections of carpet. Two of these had dimensions of 1.2 by 2.4 m and the third had dimensions of 2.4 by 2.4 m. The three sections were tightly rolled together and stored in a sealed Tedlar bag until they were used in an experiment.

A 1.1-cm thick bonded urethane carpet cushion was used for the experiments. This material was manufactured approximately one week prior to the time it was purchased from a local retailer. The 1.8 m wide roll was cut into approximately 2.4 m long sections. The material for each experiment, which consisted of three sections, was rolled together and stored in a sealed Tedlar bag until it was used.

Following the 48-h background measurement period, the two chairs, the drapery panel, the air mixing fans, and the sampling line were removed from the compartment. The carpet and carpet cushion materials for the experiment were unpacked from their storage bags outside of the compartment. The rolled materials, the installation tools and a work light were taken into the compartment by two technicians. The compartment door was closed and remained closed during most the installation period. Previously, a carpet tack strip had been attached to the floor around the inside perimeter of the compartment. The sections of carpet cushion were laid out on the floor with the smooth webbing side facing up. The sections were trimmed with a knife so that they fit inside of the tack strip. Next, the sections of carpet were laid out over the cushion. These were aligned so that the two seams ran across the short length of the compartment and were not directly over the seams in the cushion. The two seams were bonded with thermal seam tape applied with a professional seaming iron. The edges of the carpet were then trimmed with a knife so that the carpet fit closely against the walls of the compartment. The carpet was attached to the tack strip by pounding the edges down with a metal block and hammer. The carpet was not stretched, as is typical practice. The air mixing fans, the temperature and humidity probe, the thermocouples, and the sampling line were installed. The technicians exited the compartment with the work light. This established the beginning of the 336-h experimental period. The entire installation and setup procedure required approximately 50 minutes to complete. At 2-h elapsed time, the technicians re-entered the compartment and installed the two chairs, the drapery panel, and the air velocity transducer.

For one experiment, the carpet and carpet cushion materials were aired out prior to their installation in the compartment. Two days before the start of the experiment, the materials were laid out on the floor of a room that was ventilated at over ten air changes per hour. The carpet was positioned with the backing facing up and the cushion was positioned with the webbing side facing up. Four oscillating room fans were used to increase the air velocity over the surfaces of the materials. The fans were placed on the floor at the edges of the materials and were operated in the oscillating mode on their highest speed setting. At the end of the 48-h airing out period, the materials were rolled up and taken to the nearby chamber facility. Installation of the materials, as described above, began within one hour.

At the end of each experiment, the carpet and carpet cushion were removed from the compartment, and the compartment was ventilated at a high air change rate.

VINYL FLOORING ASSEMBLY

The primary materials used for the experiments with the vinyl flooring assembly were particle board underlayment, residential sheet vinyl flooring, rubber cove base and associated adhesives.

The particle board underlayment was purchased from a local building supply retailer several months prior to the initiation of these experiments. The 1.22 by 2.44 m, 1-cm thick, panels were stored in the chamber facility building. They were leaned up against several walls of the building to maximize the exposure of their surfaces to air. This was intended to reduce the emissions of VOCs from the panels; however, the reduction was not quantified. Prior to an experiment, four panels of underlayment were cut to completely cover the floor of the compartment. They were carefully cut so that the seams fit closely together and no nailing or filling would be required. The panels were then removed from the compartment, and the compartment was set up for the background measurement period as described above.

The sheet vinyl flooring was purchased through the contract flooring dealer. The roll of material was received within one week of its production by the manufacturer. Upon receipt, the roll was cut into the approximate sizes required for the experiments. There were three pieces for each experiment. Two pieces were 1.8 by 2.4 m, and the other piece was 0.9 by 2.4 m. Pieces for two experiments were tightly rolled together and stored in a sealed Tedlar bag.

The sheet flooring adhesive was packaged by the manufacturer in a 19-L container. Sufficient adhesive needed to complete the installation was transferred into a separate container for each experiment. The cove base adhesive was packaged in 0.32-L tubes with applicator spouts designed for use in a caulking gun. The seam sealer consisted of two separate liquids that are designed to be mixed together in equal portions just prior to application. The secondary container of sheet vinyl adhesive, two containers of cove base adhesive, and the installation tools consisting of two notched trowel applicators and a spatula were weighed immediately prior to and following an experiment. These weights were used to calculate the applied masses of the two adhesives.

Following the background measurement period, the two chairs, the drapery panel, the air mixing fans, and the sampling line were removed from the compartment. The technicians then installed the four panels of underlayment on top of the aluminum-clad floor. The compartment door was left open during this operation. Next, the sheet vinyl flooring material for the experiment was removed from its storage bag exterior to the compartment. The vinyl flooring, sections of cove base, adhesives, tools and a work light were taken into the compartment by the two technicians. The door was closed and remained closed during most of the installation. The vinyl flooring was laid out on the floor so that the two seams ran across the short length of the compartment. The material was trimmed to approximately the correct size with a knife. The sheet flooring adhesive was applied to the surface of the underlayment with the notched trowels. These trowels had 1.5- by 1.5-mm square teeth as recommended by the adhesive manufacturer. The adhesive was applied in stages with two stages for each piece of vinyl flooring. After the vinyl flooring was glued down, the edges were trimmed as required and any large air bubbles were worked out by rubbing the surface and applying pressure with a large towel. The cove base, which was manufactured in 1.1-m sections, was applied next. Three equally-spaced beads of adhesive running the length of a section of cove base were applied with a caulking gun. The beads were approximately 0.6 cm wide. The cove base with adhesive was then pressed against the base of the wall and down against the vinyl flooring. Finally, the seam sealer was applied to the two seams in the vinyl flooring. The sealer was prepared outside of the compartment by mixing together 7.5 mL of each of the two components in a glass vial. The mixture was applied using a 10-mL plastic disposable syringe.

The tools and the remaining and scrap materials were passed out of the compartment. The air mixing fans, the temperature and humidity probe, the thermocouples, and the sampling line were installed. The technicians exited the compartment with the work light. This established

the beginning of the 336-h experimental period. The entire installation and setup procedure required approximately 90 minutes to complete. At 2-h elapsed time, the technicians re-entered the compartment and installed the two chairs, the drapery panel, and the air velocity transducer.

For one experiment, the sheet vinyl flooring and cove base materials were aired out prior to their installation in the compartment. Two days before the start of the experiment, the materials were laid out on the floor of a room that was ventilated at over ten air changes per hour. The materials were positioned with their finished surfaces facing up. Two oscillating room fans were used to increase the air velocity over the surfaces of the materials. The fans were placed on the floor at the edges of the materials and were operated in the oscillating mode on their highest speed setting. At the end of the 48-h airing out period, the vinyl flooring was rolled up, and both materials were transported to the chamber facility. Installation of the materials began within one hour.

At the end of each experiment, the entire vinyl flooring assembly and the cove base were removed from the compartment, and the compartment was ventilated at a high air change rate.

COMBINED SOURCES

Two experiments were conducted in which all of the sources were installed in the compartment. The materials used for these installations were the same as those described above for the individual source experiments. The substrates used for the paint combination were also identical in kind and size to those described above. Two-thirds of the floor area of the compartment was covered with the carpet assembly, and the remaining one-third was covered with the vinyl flooring assembly.

The gypsum board and plywood panels, the two chairs, and the drapery panel were installed in the compartment. The aluminum-clad floor was left bare. Following the 48-h background measurement period, the furnishings were removed and the paints were applied following procedures that were identical to those described above. The ventilation rate during painting was 5.0 h⁻¹. Immediately after painting, the air mixing fans, the temperature and humidity probe, the thermocouples, and the sampling line were installed. There were no carpet and furnishings in the compartment. The technicians then exited the compartment with the work light. This established the initial time for the paint-drying period. Two hours later, the ventilation rate was reduced to 2.0 h⁻¹.

Since the magnitude of the VOC emissions from the latex paints was known to be significantly greater than the magnitude of the VOC emissions from the other two source assemblies, the flooring materials were installed three days (72 hours) after painting. This initial drying period allowed the VOC emissions from the paints to decay down to somewhat lower levels and made it more practical to collect and analyze VOC samples for compounds that were representative of all of the sources. Additionally, it is common in new construction and remodeling projects for painting to be completed prior to installation of the finish flooring materials.

Approximately 68 hours after painting, VOC and aldehyde samples were collected from the compartment and the supply air. Seventy-two hours after painting and with the chamber still operating at 2.0 h⁻¹, the installation of the carpet and vinyl flooring assemblies was initiated. The vinyl flooring assembly was installed first followed by the carpet assembly. The procedures were the same as those described above for the individual assemblies. The air mixing fans, the temperature and humidity probe, the thermocouples, the sampling line and the air velocity transducer were then installed, and the two technicians exited the compartment with the work light. This established the beginning of the experimental period. The entire installation and setup procedure required approximately 70 minutes to complete. At 2-h elapsed time, the technicians re-entered the compartment and installed the two chairs, the drapery panel, and the air velocity transducer.

One of these experiments was conducted using mild heating over approximately three days in combination with additional ventilation as a source treatment procedure. Prior to this experiment, the exterior walls, the ceiling and the floor of the compartment were insulated with fiberglass insulation in an attempt to improve the uniformity of the air and surface temperatures in the compartment. Fiberglass bats with R-11 insulation value were installed on the three exterior walls; R-19 fiberglass bats were installed on the roof deck and under the floor. Two hours after the beginning of the experimental period, two portable heaters were placed in the compartment concurrently with the installation of the furnishings. These were identical 1,500 watt, 120 VAC, fan-forced, radiant heaters. The fans were placed on the carpet on aluminum plates and positioned on either side of the door. The operation of one of the heaters was controlled by a digital, laboratory temperature controller with 0.1° C resolution that was mounted on the exterior of the compartment. The temperature probe for the controller was positioned in the compartment about 60 cm above the floor. The other heater was manually controlled from the exterior of the compartment with an on/off switch.

Immediately following the collection of the 6-h air samples, the two heaters were turned on. After several hours when the air and surface temperatures had approached the 33° C set-point temperature, the manually controlled heater was switched off. The single temperature-controlled heater was used for the duration of the heating period. The compartment was continuously heated until the collection of the 72-h air samples was completed. At this time, the heater was switched off, and the ventilation rate was reduced to 0.5 h⁻¹. Additional sets of air samples were collected during this experiment at 12- and 80-h elapsed time.

The other experiment with combined source assemblies was conducted with additional ventilation of 2.0 h⁻¹, but without heating, throughout the first 72 hours following installation of the flooring assemblies. After collection of the 72-h air samples, the ventilation rate was reduced to 0.5 h⁻¹. This experiment was conducted over a period of 12 weeks (2,016 hours) in order to measure the longer-term emissions of the target VOCs. Air samples were collected weekly following the initial two-week period.

(Page is intentionally blank)

APPENDIX H

EXPOSURE REDUCTION EXPERIMENTS WITH THE LATEX PAINT COMBINATION

Appendix H presents the analytical data for the four large-scale exposure reduction experiments with the latex paint combination. The experiments were conducted in 25.5 m³ chamber compartments over a period of 336 hours. Paints LPS2, FLP3 and SGLP3 were applied to gypsum board and plywood panels with a total surface area of 16 m². The concentrations of selected compounds and SigmaVOC were measured throughout the experiments. Specific emission rates of these components were calculated. Cumulative mass emissions and cumulative exposures were estimated.

List of Tables

	<u>Page</u>
Table H-01. Summary of environmental parameters for large-scale Experiments P-1 through P-4 with latex paints.	346
Table H-02. Paint application data for large-scale Experiments P-1 through P-4.	347
Table H-03. VOCs emitted by Paints LPS2, FLP3 and SGLP3 in large-scale Experiment P-2 at 24- and 240-hours elapsed times.	348
Table H-04. Target compounds quantified in large-scale Experiments P-1 through P-4.	349
Table H-05. Concentrations of target VOCs for large-scale Experiment P-1.	350
Table H-06. Concentrations of target VOCs for large-scale Experiment P-2.	351
Table H-07. Concentrations of target VOCs for large-scale Experiment P-3.	352
Table H-08. Concentrations of target VOCs for large-scale Experiment P-4.	353
Table H-09. Concentrations of SigmaVOC for large-scale Experiments P-1 through P-4.	354
Table H-10. Concentrations of formaldehyde for large-scale Experiments P-1 through P-4.	355
Table H-11. Concentrations of acetaldehyde for large-scale Experiments P-1 through P-4.	356
Table H-12. Quasi steady-state specific emission rates of target VOCs for large-scale Experiment P-1.	357
Table H-13. Quasi steady-state specific emission rates of target VOCs for large-scale Experiment P-2.	358
Table H-14. Quasi steady-state specific emission rates of target VOCs for large-scale Experiment P-3.	359
Table H-15. Quasi steady-state specific emission rates of target VOCs for large-scale Experiment P-4.	360
Table H-16. Quasi steady-state specific emission rates of SigmaVOC for large-scale Experiments P-1 through P-4.	361
Table H-17. Quasi steady-state specific emission rates of formaldehyde for large-scale Experiments P-1 through P-4.	362
Table H-18. Quasi steady-state specific emission rates of acetaldehyde for large-scale Experiments P-1 through P-4.	363
Table H-19. Cumulative masses of target compounds and SigmaVOC emitted over 0 - 240 and 0 - 336 hours in large-scale Experiments P-1 through P-4.	364
Table H-20. Maximum exposure concentrations of target compounds during the first 48 hours of large-scale Experiments P-1 through P-4.	365
Table H-21. Cumulative exposures to target compounds during the first 48 hours of large-scale Experiments P-1 through P-4.	365
Table H-22. Cumulative exposures to target compounds over 48 - 240 and 48 - 336 hours in large-scale Experiments P-1 through P-4.	366

Table H-01. Summary of environmental parameters for large-scale Experiments P-1 through P-4 with latex paints.

Parameter	Experiment			
	P-1	P-2	P-3	P-4*
Starting date	10/10/96	10/22/96	11/13/96	12/09/96
Treatment	Base case	Base case	Add ventilation	Add ventilation & mixing
Ventilation rate, 2 - 72 h (h⁻¹)				
Average \pm 1 std. dev.	0.50 \pm 0.01 [†]	0.50 \pm 0.01 [†]	1.95 \pm 0.01 [‡]	1.88 \pm 0.01 [‡]
Range	0.50 - 0.51	0.49 - 0.50	1.91 - 1.98	1.85 - 1.91
Ventilation rate, 72 - 336 h (h⁻¹)				
Average \pm 1 std. dev.	0.50 \pm 0.01	0.50 \pm 0.01	0.50 \pm 0.01	0.50 \pm 0.01
Range	0.49 - 0.51	0.49 - 0.50	0.49 - 0.51	0.49 - 0.52
Temperature, 2 - 336 h (°C)				
Average \pm 1 std. dev.	23.1 \pm 1.1	23.1 \pm 0.6	23.8 \pm 0.3	23.1 \pm 0.6
Range	20.7 - 25.7	21.7 - 25.4	23.0 - 25.2	22.1 - 24.5
Relative Humidity, 2 - 336 h (%)				
Average \pm 1 std. dev.	43 \pm 10	38 \pm 5	44 \pm 6	48 \pm 5
Range	24 - 61	24 - 48	33 - 53	37 - 56

*Experiment P-4 was terminated at 240-h elapsed time.

[†]Ventilation rate for 0 - 2 hours was 2 h⁻¹.[‡]Ventilation rate for 0 - 2 hours was 5 h⁻¹.

Table H-02. Paint application data for large-scale Experiments P-1 through P-4. See Appendix C, Table C-01 for paint descriptions.

Experiment/ Paint	Area (m²)	Mass (g)	Coverage (g m⁻²)
P-1			
LPS2	16.0	1,610	101
FLP3	14.9	1,590	107
SGLP3	1.1	110	100
Total*	16.0	3,310	207
P-2			
LPS2	16.0	2,000	125
FLP3	14.9	1,570	105
SGLP3	1.1	114	104
Total*	16.0	3,680	230
P-3			
LPS2	16.0	1,880	118
FLP3	14.9	1,610	108
SGLP3	1.1	115	105
Total*	16.0	3,600	225
P-4			
LPS2	16.0	2,030	127
FLP3	14.9	1,570	106
SGLP3	1.1	115	103
Total*	16.0	3,720	232

*Total area was used in specific emission rate calculations.

Table H-03. VOCs emitted by Paints LPS2, FLP3 and SGLP3 in large-scale Experiment P-2 at 24- and 240-hours elapsed times.

COMPOUND	Code*	24-h ET	240-h ET	Match Quality
Aromatic Hydrocarbons				
m-,p-Xylene	T,B	+		Confirmed
4-Phenylcyclohexene	B		+	Confirmed
Other Hydrocarbons				
alpha-Pinene	B	+	+	Confirmed
3-Carene	B		+	Confirmed
Carbonyl Compounds				
Hexanal	B	+	+	Confirmed
Octanal	B	+		Confirmed
Nonanal	B	+	+	Confirmed
Decanal	B	+	+	Confirmed
Other Oxidized Compounds				
Acetic acid	B	+	+	Confirmed
Ethylene glycol	T,A,Q	+	+	Confirmed
n-Butyl ether	Q	+		Confirmed
Propylene glycol	A,Q	+	+	Confirmed
Ethylene glycol monoacetate		+		Probable
Hexylene glycol		+		Confirmed
2-Ethyl-1-hexanol	Q	+		Confirmed
2-(2-Butoxyethoxy)ethanol	T,Q	+	+	Confirmed
Unidentified oxidized compound		+	+	Unident.
2,2,4-Trimethyl-1,3-pentanediol monoisobutyrate isomers (Texanol)	A,Q	+	+	Confirmed

*T = Toxic air contaminant; A = Abundant compound; B = Component of chamber background;
Q = Quantified target compound.

Table H-04. Target compounds quantified in large-scale Experiments P-1 through P-4. Toxic Air Contaminant (TAC) Category for June 1996 is indicated where applicable.

Compound	TAC Cat.	Table Abbrev.	Sources
Carbonyl Compounds			
Formaldehyde	I		FLP3,SGLP3
Acetaldehyde	I		FLP3,SGLP3
Other Oxidized Cmpds.			
Ethylene glycol	I	EG	LPS2,FLP3
Propylene glycol		PG	LPS2,SGLP3
n-Butyl ether			LPS2,FLP3,SGLP3
2-Ethyl-1-hexanol			LPS2
2-(2-Butoxyethoxy)ethanol	I	DEGBE	LPS2,SGLP3
2,2,4-Trimethyl-1,3-pentanediol monoisbutyrates (combined isomers)		Texanol	LPS2,FLP3,SGLP3

Table H-05. Concentrations of target VOCs for large-scale Experiment P-1.

Sample ID	Chamber Concentration, $\mu\text{g m}^{-3}$					
	EG	PG	Butyl ether	Ethyl- hexanol	DEGBE	Texanol
Avg. Inlet	<33	<12	<1	<1	<1	<2
Background	<33	<12	<1	<1	<1	<2
1-h	3,640	840	530	160	60	3,870
3-h	14,300	2,340	276	116	92	2,890
6-h	8,060	1,070	214	99	63	3,550
24-h	1,400	309	50	30	32	3,070
48-h	1,140	190	27	15	28	2,640
72-h	1,150	148	17	8	15	3,000
96-h	707	96	11	6	15	2,410
120-h	500	36	8	5	10	1,930
144-h	245	40	7	3	7	1,680
168-h	299	27	5	3	6	1,640
192-h	373	27	4	2	5	1,560
216-h	294	31	4	3	5	1,360
240a-h	220	27	3	2	4	980
240b-h	202	26	4	2	4	1,310
336-h	316	42	3	1	5	1,530

Table H-06. Concentrations of target VOCs for large-scale Experiment P-2.

Sample ID	Chamber Concentration, $\mu\text{g m}^{-3}$					
	EG	PG	Butyl ether	Ethyl- hexanol	DEGBE	Texanol
Avg. Inlet	<33	<12	<1	<1	<1	<2
Background	<33	<12	<1	<1	<1	<2
1-h	16,100	4,020	554	169	84	3,330
3-h	19,500	3,740	265	108	108	4,640
6-h	10,500	2,260	227	91	82	3,970
24-h	3,160	756	49	38	60	2,660
48-h	1,580	364	23	18	42	3,180
72-h	776	114	13	8	20	2,890
96-h	691	89	8	5	16	md*
120a-h	396	44	5	4	12	1,840
120b-h	287	38	5	3	10	1,950
144-h	364	49	4	4	10	1,660
168a-h	715	89	5	2	14	1,920
168b-h	664	77	5	3	12	1,850
192-h	625	58	5	3	11	1,600
216-h	576	53	6	4	10	1,490
240-h	537	45	5	3	8	1,290
336a-h	274	md	3	3	4	1,020
336b-h	304	27	3	2	5	1,310

*md = missing or invalidated data.

Table H-07. Concentrations of target VOCs for large-scale Experiment P-3.

Sample ID	Chamber Concentration, $\mu\text{g m}^{-3}$					
	EG	PG	Butyl ether	Ethyl- hexanol	DEGBE	Texanol
Avg. Inlet	<33	<12	<1	<1	<1	<2
Background	<33	<12	<1	<1	<1	27
1-h	16,400	4,640	110	76	119	5,590
3a-h	13,800	2,920	96	53	96	4,600
3b-h	13,800	2,960	85	51	96	4,100
6-h	7,920	1,910	59	38	85	3,630
24-h	1,390	284	8	13	34	2,710
48-h	638	123	3	4	17	1,390
72-h	522	83	2	2	12	1,250
96-h	735	166	9	4	16	1,860
120a-h	758	133	10	3	17	1,820
120b-h	765	131	11	5	17	2,050
144-h	627	102	9	3	14	1,910
168a-h	641	91	9	3	14	1,930
168b-h	597	88	8	3	12	md*
192-h	520	71	8	3	9	1,700
216-h	507	73	8	<1	10	1,610
240-h	328	42	5	<1	8	1,580
336-h	199	<10	3	<1	4	1,420

*md = Missing or invalidated data.

Table H-08. Concentrations of target VOCs for large-scale Experiment P-4. Experiment was terminated at 240-h elapsed time (see Report).

Sample ID	Chamber Concentration, $\mu\text{g m}^{-3}$					
	EG	PG	Butyl ether	Ethyl- hexanol	DEGBE	Texanol
Avg. Inlet	<33	<12	<1	<1	<1	<2
Background	<33	<12	<1	1	<1	10
1-h	7,670	2,970	87	58	87	4,370
3-h	10,100	2,640	82	43	106	3,430
6-h	5,190	1,490	53	34	77	3,560
24-h	1,750	370	11	11	45	2,090
48-h	860	160	5	5	23	1,530
72-h	590	94	3	2	14	1,740
96-h	570	90	8	4	15	1,410
120-h	410	63	6	3	11	1,440
144-h	330	41	4	2	8	1,160
168-h	480	75	5	3	10	1,350
192-h	340	54	4	3	9	1,430
216a-h	230	27	3	2	6	1,230
216b-h	290	34	3	2	6	1,480
240-h	300	40	3	2	7	1,450

Table H-09. Concentrations of SigmaVOC (*i.e.*, sum of six target VOCs) for large-scale Experiments P-1 through P-4.

Sample ID	Chamber Concentration, $\mu\text{g m}^{-3}$			
	Exp P-1	Exp P-2	Exp P-3	Exp P-4
Avg. Inlet	<50	<50	<50	<50
Background	<50	<50	<50	<50
1-h	9,100	24,300	26,900	15,200
3a-h	20,000	28,400	21,600	16,400
3b-h	---	---	21,100	---
6-h	13,100	17,200	13,600	10,400
24-h	4,890	2,660	4,440	4,280
48-h	4,040	3,180	2,170	2,580
72-h	4,340	2,890	1,870	2,440
96-h	3,240	3,170*	2,790	2,100
120a-h	2,490	2,300	2,740	1,940
120b-h	---	2,290	2,980	---
144-h	1,980	2,090	2,660	1,540
168a-h	1,980	2,740	2,690	1,920
168b-h	---	2,610	---	---
192-h	1,970	2,300	2,280	1,840
216a-h	1,700	2,140	2,210	1,500
216b-h	---	---	---	1,810
240a-h	1,240	1,890	1,970	1,800
240b-h	1,550	---	---	---
336a-h	1,900	1,330	1,630	md**
336b-h	---	1,650	---	---

*Concentration of Texanol for this sample was estimated as the average of the concentrations for the immediately preceding and subsequent samples.

**md = Missing data; Experiment P-4 was terminated at 240-h elapsed time.

Table H-10. Concentrations of formaldehyde for large-scale Experiments P-1 through P-4.

Sample ID	Chamber Concentration, $\mu\text{g m}^{-3}$			
	Exp P-1	Exp P-2	Exp P-3	Exp P-4
Avg. Inlet*	<1.0	1.2 ± 0.5	1.3 ± 1.2	<1.0
Background	4.8	1.1	7.0	6.1
1-h	42.9	104	25.6	19.0
3-h	21.0	62.8	14.0	10.4
6-h	17.5	23.0	9.7	9.5
24-h	11.0	md**	2.9	7.6
48-h	9.3	11.2	1.3	5.3
72-h	9.0	10.3	<1.0	4.8
96-h	6.0	7.4	11.4	7.6
120-h	6.8	3.1	10.9	6.2
144-h	5.4	3.2	10.9	5.5
168-h	5.1	7.9	10.3	7.7
192-h	6.6	5.1	10.0	5.8
216-h	7.0	7.5	10.0	7.5
240-h	4.6	8.4	9.4	6.0
336-h	8.1	7.0	4.4	md

*Average \pm 1 standard deviation.

**md = Missing data or invalid data; Experiment P-4 was terminated at 240-h elapsed time.

Table H-11. Concentrations of acetaldehyde for large-scale Experiments P-1 through P-4.

Sample ID	Chamber Concentration, $\mu\text{g m}^{-3}$			
	Exp P-1	Exp P-2	Exp P-3	Exp P-4
Avg. Inlet*	6.8 \pm 5.3	3.0 \pm 4.5	<1.0	1.0 \pm 0.7
Background	6.8	2.3	8.3	8.3
1-h	1,250	1,440	133	110
3-h	141	147	21.1	17.6
6-h	73.4	69.9	13.6	12.4
24-h	26.6	md**	3.3	6.0
48-h	27.2	15.8	2.3	4.7
72-h	26.0	12.9	2.1	4.7
96-h	18.2	12.0	12.8	11.5
120-h	20.2	11.9	13.4	8.3
144-h	15.6	9.9	11.6	8.5
168-h	15.7	12.8	12.3	10.2
192-h	12.8	16.6	11.5	9.0
216-h	9.0	12.6	11.5	7.9
240-h	6.7	12.1	9.3	8.3
336-h	16.3	10.6	7.3	md

*Average \pm 1 standard deviation.

**md = Missing data or invalid data; Experiment P-4 was terminated at 240-h elapsed time.

Table H-12. Quasi steady-state specific emission rates ($\text{mg m}^{-2} \text{h}^{-1}$) of target VOCs for large-scale Experiment P-1.

Sample ID	Specific Emission Rate, $\text{mg m}^{-2} \text{h}^{-1}$					
	EG	PG	Butyl ether	Ethyl- hexanol	DEGBE	Texanol
1-h	11.6	2.68	1.69	0.510	0.191	12.3
3-h	11.4	1.86	0.220	0.092	0.073	2.30
6-h	6.42	0.851	0.171	0.079	0.051	2.83
24-h	1.12	0.246	0.039	0.024	0.0256	2.45
48-h	0.907	0.151	0.021	0.012	0.022	2.11
72-h	0.915	0.118	0.013	0.007	0.012	2.39
96-h	0.563	0.077	0.009	0.005	0.012	1.92
120-h	0.398	0.029	0.007	0.004	0.008	1.54
144-h	0.195	0.032	0.005	0.002	0.005	1.34
168-h	0.238	0.021	0.004	0.002	0.005	1.31
192-h	0.298	0.022	0.003	0.002	0.004	1.24
216-h	0.234	0.025	0.003	0.002	0.004	1.08
240-h	0.168	0.021	0.003	0.002	0.003	0.911
336-h	0.252	0.034	0.002	0.001	0.004	1.22

Table H-13. Quasi steady-state specific emission rates ($\text{mg m}^{-2} \text{h}^{-1}$) of target VOCs for large-scale Experiment P-2.

Sample ID	Specific Emission Rate, $\text{mg m}^{-2} \text{h}^{-1}$					
	EG	PG	Butyl ether	Ethyl- hexanol	DEGBE	Texanol
1-h	51.5	12.8	1.77	0.538	0.269	10.6
3-h	15.6	2.98	0.211	0.086	0.086	3.70
6-h	8.40	1.80	0.181	0.072	0.065	3.17
24-h	2.52	0.603	0.039	0.030	0.048	2.12
48-h	1.26	0.290	0.019	0.014	0.033	2.53
72-h	0.618	0.091	0.011	0.006	0.016	2.30
96-h	0.551	0.071	0.006	0.004	0.013	1.88*
120-h	0.272	0.033	0.004	0.003	0.008	1.51
144-h	0.290	0.039	0.003	0.003	0.008	1.33
168-h	0.550	0.066	0.004	0.002	0.010	1.50
192-h	0.498	0.046	0.004	0.002	0.008	1.27
216-h	0.459	0.042	0.005	0.003	0.008	1.18
240-h	0.428	0.036	0.004	0.002	0.006	1.03
336-h	0.230	0.022	0.002	0.002	0.003	0.928

*Concentration of Texanol used in the calculation for this sample was estimated as the average of the concentrations for the immediately preceding and subsequent samples.

Table H-14. Quasi steady-state specific emission rates ($\text{mg m}^{-2} \text{h}^{-1}$) of target VOCs for large-scale Experiment P-3.

Sample ID	Specific Emission Rate, $\text{mg m}^{-2} \text{h}^{-1}$					
	EG	PG	Butyl ether	Ethyl- hexanol	DEGBE	Texanol
1-h	126.1	35.5	0.843	0.583	0.908	42.6
3-h	43.0	9.12	0.280	0.162	0.298	13.4
6-h	24.6	5.93	0.184	0.119	0.263	11.2
24-h	4.32	0.882	0.026	0.040	0.105	8.34
48-h	1.98	0.381	0.010	0.012	0.054	4.22
72-h	1.62	0.259	0.008	0.008	0.038	3.79
96-h	0.586	0.132	0.007	0.004	0.013	1.46
120-h	0.607	0.105	0.008	0.003	0.014	1.52
144-h	0.500	0.081	0.007	0.002	0.011	1.50
168-h	0.493	0.071	0.007	0.002	0.010	1.52
192-h	0.414	0.057	0.006	0.002	0.007	1.33
216-h	0.404	0.058	0.006	<0.001	0.008	1.26
240-h	0.261	0.033	0.004	<0.001	0.006	1.24
336-h	0.159	<0.008	0.002	<0.001	0.003	1.11

Table H-15. Quasi steady-state specific emission rates ($\text{mg m}^{-2} \text{h}^{-1}$) of target VOCs for large-scale Experiment P-4. Experiment was terminated at 240-h elapsed time.

Sample ID	Specific Emission Rate, $\text{mg m}^{-2} \text{h}^{-1}$					
	EG	PG	Butyl ether	Ethyl- hexanol	DEGBE	Texanol
1-h	62.4	24.1	0.703	0.461	0.703	35.4
3-h	30.2	7.91	0.245	0.127	0.317	10.2
6-h	15.6	4.47	0.158	0.098	0.230	10.6
24-h	5.24	1.11	0.032	0.029	0.134	6.22
48-h	2.57	0.481	0.014	0.011	0.069	4.56
72-h	1.76	0.281	0.009	0.004	0.041	5.17
96-h	0.456	0.072	0.006	0.002	0.012	1.12
120-h	0.329	0.050	0.005	0.002	0.009	1.14
144-h	0.262	0.033	0.003	0.001	0.007	0.919
168-h	0.383	0.059	0.004	0.002	0.008	1.07
192-h	0.272	0.043	0.003	0.001	0.007	1.13
216-h	0.208	0.024	0.002	0.001	0.005	1.07
240-h	0.238	0.032	0.002	0.001	0.005	1.15

Table H-16. Quasi steady-state specific emission rates ($\text{mg m}^{-2} \text{h}^{-1}$) of SigmaVOC (*i.e.*, sum of six target VOCs) for large-scale Experiments P-1 through P-4.

Sample ID	Specific Emission Rate, $\text{mg m}^{-2} \text{h}^{-1}$			
	Exp P-1	Exp P-2	Exp P-3	Exp P-4
1-h	2.90	77.5	206	124
3-h	16.0	22.6	66.3	49.0
6-h	10.4	13.7	42.3	31.1
24-h	3.90	5.36	13.7	12.8
48-h	3.22	4.15	6.66	7.70
72-h	3.46	3.04	5.72	7.27
96-h	2.59	2.55	2.20	1.67
120-h	1.98	1.83	2.26	1.54
144-h	1.58	1.67	2.10	1.23
168-h	1.58	2.13	2.10	1.52
192-h	1.57	1.83	1.82	1.46
216-h	1.35	1.70	1.74	1.31
240-h	1.11	1.51	1.55	1.43
336-h	1.51	1.18	1.27	md*

*md = Missing data; Experiment P-4 was terminated at 240-h elapsed time.

Table H-17. Quasi steady-state specific emission rates of formaldehyde for large-scale Experiments P-1 through P-4.

Sample ID	Specific Emission Rate, $\mu\text{g m}^{-2} \text{h}^{-1}$			
	Exp P-1	Exp P-2	Exp P-3	Exp P-4
1-h	121	328	148	103
3-h	12.9	49.1	22.4	13.6
6-h	10.1	17.4	8.6	11.0
24-h	5.0	12.7*	<6.4	<6.4
48-h	3.6	8.0	<6.4	<6.4
72-h	3.3	7.3	<6.4	<6.4
96-h	<1.6	5.0	3.6	<1.6
120-h	1.6	1.6	3.1	<1.6
144-h	<1.6	1.6	3.1	<1.6
168-h	<1.6	5.4	2.7	<1.6
192-h	<1.6	3.2	2.4	<1.6
216-h	1.7	5.1	2.4	<1.6
240-h	<1.6	5.8	1.9	<1.6
336-h	2.6	4.6	<1.6	md**

*Concentration of formaldehyde for this sample was estimated as the average of the concentrations for the immediately preceding and subsequent samples.

**md = Missing data; Experiment P-4 was terminated at 240-h elapsed time.

Table H-18. Quasi steady-state specific emission rates of acetaldehyde for large-scale Experiments P-1 through P-4.

Sample ID	Specific Emission Rate, $\mu\text{g m}^{-2} \text{h}^{-1}$			
	Exp P-1	Exp P-2	Exp P-3	Exp P-4
1-h	3,970	4,580	997	812
3-h	107	114	40.6	29.6
6-h	53.0	53.3	16.8	12.9
24-h	15.7	31.8*	<6.4	<6.4
48-h	16.3	10.2	<6.4	<6.4
72-h	15.3	7.9	<6.4	<6.4
96-h	9.1	7.2	3.6	2.5
120-h	10.6	7.1	4.0	<1.6
144-h	7.0	5.5	2.6	<1.6
168-h	7.1	7.8	3.1	<1.6
192-h	4.8	10.8	2.5	<1.6
216-h	1.8	7.7	2.5	<1.6
240-h	<1.6	7.2	<1.6	<1.6
336-h	7.6	6.0	<1.6	md**

*Concentration of acetaldehyde for this sample was estimated as the average of the concentrations for the immediately preceding and subsequent samples.

**md = Missing data; Experiment P-4 was terminated at 240-h elapsed time.

Table H-19. Cumulative masses (milligrams) of target compounds and SigmaVOC emitted over 0 - 240 and 0 - 336 hours in large-scale Experiments P-1 through P-4.

Compound	Exp P-1	Cumulative Mass, mg		Exp P-4*
		Exp P-2	Exp P-3	
0 - 240 Hour Period				
Formaldehyde	<13	35	<18	<11
Acetaldehyde	173	197	<47	<35
Ethylene glycol	3,750	6,340	13,900	10,000
Propylene glycol	572	1,300	3,240	2,620
n-Butyl ether	131	130	102	88
2-Ethyl-1-hexanol	55	58	71	55
2-(2-Butoxyethoxy)ethanol	54	80	182	181
2,2,4-Trimethyl-1,3-pentanediol monoisobutyrate (Texanol)	6,930	7,130	13,200	11,800
SigmaVOC**	11,500	15,000	30,700	24,800
0 - 336 Hour Period				
Formaldehyde	<16	43	<20	---
Acetaldehyde	180	207	<48	---
Ethylene glycol	4,080	6,840	14,200	---
Propylene glycol	614	1,350	3,260	---
n-Butyl ether	134	136	107	---
2-Ethyl-1-hexanol	57	62	71	---
2-(2-Butoxyethoxy)ethanol	59	88	189	---
2,2,4-Trimethyl-1,3-pentanediol monoisobutyrate (Texanol)	8,570	8,630	15,000	---
SigmaVOC**	13,500	17,100	32,900	---

*Experiment P-4 was terminated at 240-h elapsed time.

**SigmaVOC includes all target compounds except formaldehyde and acetaldehyde.

Table H-20. Maximum exposure concentrations (ppb) of target compounds during the first 48 hours of large-scale Experiments P-1 through P-4.

Compound	Maximum Concentration, ppb			
	Exp P-1	Exp P-2	Exp P-3	Exp P-4
Formaldehyde	35	85	21	15
Acetaldehyde	696	800	74	61
Ethylene glycol	5,650	7,700	6,490	3,980
Propylene glycol	752	1,300	1,500	955
n-Butyl ether	100	104	21	16
2-Ethyl-1-hexanol	30	32	14	11
2-(2-Butoxyethoxy)ethanol	14	16	18	16
2,2,4-Trimethyl-1,3-pentanediol monoisobutyrate (Texanol)	438	525	633	494

Table H-21. Cumulative exposures (ppm-hour) to target compounds during the first 48 hours of large-scale Experiments P-1 through P-4. Estimates assume 20 hours of occupancy per day.

Compound	Cumulative Exposure, ppm-hour			
	Exp P-1	Exp P-2	Exp P-3	Exp P-4
Formaldehyde	0.44	0.71	0.17	0.26
Acetaldehyde	1.80	2.01	0.23	0.24
Ethylene glycol	55.5	88.5	58.9	45.4
Propylene glycol	7.26	15.9	11.2	9.76
n-Butyl ether	0.80	0.81	0.19	0.18
2-Ethyl-1-hexanol	0.37	0.39	0.15	0.13
2-(2-Butoxyethoxy)ethanol	0.25	0.38	0.28	0.30
2,2,4-Trimethyl-1,3-pentanediol monoisobutyrate (Texanol)	13.8	14.4	12.4	10.8

Table H-22. Cumulative exposures (ppm-hour) to target compounds over 48 - 240 and 48 - 336 hours in large-scale Experiments P-1 through P-4. Estimates assume 20 hours of occupancy per day.

Compound	Cumulative Exposure, ppm-hour			
	Exp P-1	Exp P-2	Exp P-3	Exp P-4*
48 - 240 Hour Period				
Formaldehyde	<0.31	0.73	<0.31	<0.31
Acetaldehyde	0.89	0.87	<0.21	<0.21
Ethylene glycol	33.5	40.4	37.7	28.1
Propylene glycol	3.31	4.45	5.15	3.53
n-Butyl ether	0.27	0.23	0.23	0.14
2-Ethyl-1-hexanol	0.14	0.15	0.08	0.08
2-(2-Butoxyethoxy)ethanol	0.24	0.35	0.32	0.27
2,2,4-Trimethyl-1,3-pentanediol monoisobutyrate (Texanol)	35.1	36.3	31.0	25.8
48 - 336 Hour Period				
Formaldehyde	<0.47	1.15	<0.47	---
Acetaldehyde	1.10	1.24	<0.32	---
Ethylene glycol	41.8	53.5	46.0	---
Propylene glycol	4.19	5.37	5.68	---
n-Butyl ether	0.31	0.29	0.28	---
2-Ethyl-1-hexanol	0.17	0.19	0.08	---
2-(2-Butoxyethoxy)ethanol	0.29	0.42	0.39	---
2,2,4-Trimethyl-1,3-pentanediol monoisobutyrate (Texanol)	47.2	47.4	44.6	---

*Experiment P-4 was terminated at 240-h elapsed time.

APPENDIX I

EXPOSURE REDUCTION EXPERIMENTS WITH THE CARPET ASSEMBLY

Appendix I presents the analytical data for the three large-scale exposure reduction experiments with the carpet assembly. The experiments were conducted in 25.5 m³ chamber compartments over a period of 336 hours. The 10.4-m² floor area was carpeted with Carpet Cushion CC4 and Carpet CP4. The concentrations of selected compounds and TVOC were measured throughout the experiments. Specific emission rates of these components were calculated. Cumulative mass emissions and cumulative exposures were estimated.

List of Tables

	<u>Page</u>
Table I-01. Summary of environmental parameters for large-scale Experiments C-1 through C-3 with carpet materials.	368
Table I-02. Carpet materials and quantities used in large-scale Experiments C-1 through C3.....	369
Table I-03. VOCs emitted by carpet assembly in large-scale Experiment C-1 at 24- and 240-hours elapsed times.....	370
Table I-04. Target compounds quantified in large-scale Experiments C-1 through C-3.....	373
Table I-05. Concentrations of Group 1 target VOCs for large-scale Experiment C-1.....	374
Table I-06. Concentrations of Group 2 target VOCs for large-scale Experiment C-1.....	375
Table I-07. Concentrations of Group 1 target VOCs for large-scale Experiment C-2.....	376
Table I-08. Concentrations of Group 2 target VOCs for large-scale Experiment C-2.....	377
Table I-09. Concentrations of Group 1 target VOCs for large-scale Experiment C-3.....	378
Table I-10. Concentrations of Group 2 target VOCs for large-scale Experiment C-3.....	379
Table I-11. Concentrations TVOC for large-scale Experiments C-1 through C-3.....	380
Table I-12. Concentrations of SigmaVOC for large-scale Experiments C-1 through C-3.....	381
Table I-13. Concentrations of formaldehyde and acetaldehyde for large-scale Experiment C-1.	382
Table I-14. Quasi steady-state specific emission rates of Group 1 target VOCs for large-scale Experiment C-1.....	383
Table I-15. Quasi steady-state specific emission rates of Group 2 target VOCs for large-scale Experiment C-1.....	384
Table I-16. Quasi steady-state specific emission rates of Group 1 target VOCs for large-scale Experiment C-2.....	385
Table I-17. Quasi steady-state specific emission rates of Group 2 target VOCs for large-scale Experiment C-2.....	386
Table I-18. Quasi steady-state specific emission rates of Group 1 target VOCs for large-scale Experiment C-3.....	387
Table I-19. Quasi steady-state specific emission rates of Group 2 target VOCs for large-scale Experiment C-3.....	388
Table I-20. Quasi steady-state specific emission rates of TVOC for large-scale Experiments C-1 through C-3.....	389
Table I-21. Cumulative masses of target VOCs and TVOC emitted over 0 - 336 hours in large-scale Experiments C-1 through C-3.....	390
Table I-22. Cumulative exposures to target VOCs during the first 48 hours of large-scale Experiments C-1 through C-3.....	391
Table I-23. Cumulative exposures to target VOCs over 48 - 336 hours in large-scale Experiments C-1 through C-3.....	392

Table I-01. Summary of environmental parameters for large-scale Experiments C-1 through C-3 with carpet materials.

Parameter	C-1	Experiment C-2	C-3
Starting date	3/17/97	4/29/97	6/02/97
Treatment	Base case	Add ventilation	Air out CP, CC
Ventilation rate, 2 - 72 h (h⁻¹)			
Average \pm 1 std. dev.	0.50 \pm 0.01*	1.91 \pm 0.01†	0.50 \pm 0.01*
Range	0.49 - 0.51	1.87 - 1.94	0.49 - 0.50
Ventilation rate, 72 - 336 h (h⁻¹)			
Average \pm 1 std. dev.	0.50 \pm 0.01	0.49 \pm 0.01	0.50 \pm 0.01
Range	0.49 - 0.50	0.48 - 0.49	0.49 - 0.50
Temperature (°C), 2 - 336 h (h⁻¹)			
Average \pm 1 std. dev.	23.9 \pm 1.1	23.3 \pm 1.3	23.6 \pm 1.1
Range	22.1 - 26.6	19.3 - 26.0	21.5 - 25.7
Relative Humidity (%), 2 - 336 h (h⁻¹)			
Average \pm 1 std. dev.	50 \pm 7	51 \pm 4	53 \pm 4
Range	34 - 61	38 - 59	47 - 61

*Ventilation rate for 0 - 2 hours was 2 h⁻¹.†Ventilation rate for 0 - 2 hours was 5 h⁻¹.

Table I-02. Carpet materials and quantities used in large-scale Experiments C-1 through C-3.
See Appendix D, Table D-01, for complete material descriptions.

Material Description	Material ID	Unit of Measure	Exp C-1	Quantity Exp C-2	Exp C-3
Commercial olefin carpet*	CP4	m ²	10.4	10.4	10.4
Bonded urethane carpet cushion	CC4	m ²	9.43	9.43	9.43
Thermal seam tape	ST	m	4.57	4.57	4.57

*Area of carpet was used in specific emission rate calculations.

Table I-03. VOCs emitted by carpet assembly in large-scale Experiment C-1 at 24- and 240-hours elapsed times.

COMPOUND	Code*	RT (min)	24-h ET	240-h ET	Match Quality
Alkane Hydrocarbons					
n-Octane		12.2	+		Confirmed
n-Nonane		14.0	+		Confirmed
Branched alkane HC		20.3	+		Probable
Branched alkane HC		21.0	+	+	Probable
Branched alkane HC		21.6	+	+	Probable
Branched alkane HC		21.8	+	+	Probable
Branched alkane HC		23.1	+		Probable
Branched alkane HC		23.4	+		Probable
Branched alkane HC	A	28.9	+	+	Probable
Branched alkane HC		29.2	+	+	Probable
Branched alkane HC		29.4	+	+	Probable
Branched alkane HC		29.6	+	+	Probable
Branched alkane HC	A	30.3	+	+	Probable
Branched alkane HC		30.6	+	+	Probable
Branched alkane HC		30.9	+	+	Probable
Branched alkane HC		35.1	+	+	Probable
Branched alkane HC		36.3	+	+	Probable
Aromatic Hydrocarbons					
Toluene	T	11.9	+		Confirmed
m-,p-Xylene	T	16.3	+		Confirmed
o-Xylene	T	17.5	+		Confirmed
Styrene	T,Q	17.8	+		Confirmed
Isopropylbenzene		18.4	+		Confirmed
Propylbenzene		19.6	+		Confirmed
4-Isopropyltoluene	B	22.2	+	+	Confirmed
4-Phenylcyclohexene	A,Q	33.2	+	+	Confirmed
Other Hydrocarbons					
4-Ethenylcyclohexene	Q	13.8	+	+	Confirmed
alpha-Pinene	B	17.6	+	+	Confirmed
Camphene	B	18.5	+	+	Confirmed
beta-Pinene	B	19.7	+	+	Confirmed
Alkene HC		19.8	+	+	Probable
Alkene HC		19.9	+	+	Probable
beta-Myrcene	B	20.2	+	+	Confirmed
Alkene HC		20.6	+		Probable
Alkene HC		20.7	+		Probable
Alkene HC		20.8	+		Probable
3-Carene	B	20.8	+	+	Confirmed
Alkene HC		21.4	+		Probable
d-Limonene	B	21.6	+	+	Confirmed
Alkene HC		21.9	+		Probable
Alkene HC		22.3	+		Probable
Alkene HC		22.5	+	+	Probable

Table I-03, Continued. VOCs emitted by carpet assembly in large-scale Experiment C-1 at 24- and 240-hours elapsed times.

COMPOUND	Code*	RT (min)	24-h ET	240-h ET	Match Quality
Other Hydrocarbons, Cont.					
Alkene HC		22.7	+		Probable
Alkene HC		23.0	+	+	Probable
Alkene HC		23.2	+	+	Probable
Alkene HC		23.4	+	+	Probable
Alkene HC		23.6	+	+	Probable
Alkene HC		24.0	+		Probable
Alkene HC		25.5	+		Probable
Alkene HC		28.8	+	+	Tentative
Alkene HC		30.0	+	+	Probable
Alkene HC		30.2	+	+	Probable
Alkene HC		37.3	+	+	Tentative
Unsaturated HCs, unresolved isomers	A	26-40	+	+	Probable
Halogenated Compounds					
1,3-Dichloropropanol		22.6	+	+	Confirmed
1,2-Dichlorobenzene	Q	23.9	+	+	Confirmed
Carbonyl Compounds					
Pentanal	B	10.2	+	+	Confirmed
Hexanal	B	14.6	+	+	Confirmed
2-Furancarboxaldehyde	B	18.2	+	+	Confirmed
Benzaldehyde	B	22.6	+	+	Confirmed
Octanal	B	22.7	+	+	Confirmed
Nonanal	B	26.2	+	+	Confirmed
Decanal	B	29.5		+	Confirmed
Other Oxidized Compounds					
1-Butanol	B	9.9	+	+	Confirmed
Acetic acid	B	10.1	+	+	Confirmed
1-Pentanol	B	14.3	+	+	Confirmed
Ethylene glycol	T,B	15.3	+	+	Confirmed
Propylene glycol	B	16.6	+	+	Confirmed
Di(propylene glycol)methyl ether, isomer 1	Q	23.1	+		Confirmed
Di(propylene glycol)methyl ether, isomer 2	Q	23.3	+		Confirmed
Di(propylene glycol)methyl ether, isomer 3	A,Q	23.8	+	+	Confirmed
Phenol	T,B,Q	26.6	+	+	Confirmed
Phenethyl alcohol	Q	28.8	+		Confirmed
1-Decanol	Q	31.8	+	+	Confirmed
2,2,4-Trimethyl-1,3-pentanediol monoisobutyrate (Texanol 1)	B	35.4	+	+	Confirmed

Table I-03, Continued. VOCs emitted by carpet assembly in large-scale Experiment C-1 at 24- and 240-hours elapsed times.

COMPOUND	Code*	RT (min)	24-h ET	240-h ET	Match Quality
Other Oxidized Cmpds, Cont.					
2,2,4-Trimethyl-1,3-pentanediol monoisobutyrate (Texanol 3)	B	35.8	+	+	Confirmed
2,6-Di- <i>tert</i> -butyl-4-methylphenol (butylated hydroxytoluene)	A,Q	37.9	+	+	Confirmed
Nitrogen-Containing Compounds					
N,N-Dimethylacetamide	Q	20.5	+		Confirmed
N,N-Dimethylbenzylamine	A,Q	23.2	+	+	Confirmed
2,2'-Azobisisobutyronitrile	A,Q	27.4	+	+	Confirmed
2-Methyleneglutaronitrile	Q	31.3	+	+	Confirmed
Miscellaneous Compounds					
Hexamethylcyclotrisiloxane	B	12.2	+	+	Confirmed
Octamethylcyclotetrasiloxane	B	18.8	+	+	Confirmed
Unidentified Compounds					
Unidentified compound		22.3		+	Unident.
Unidentified glycol ether		26.5	+	+	Unident.
Unidentified glycol ether		27.3	+	+	Unident.
Unidentified glycol ether		27.5	+	+	Unident.
Unidentified glycol ether		27.6	+	+	Unident.

*T = Toxic air contaminant; A = Abundant compound; B = Component of chamber background;
Q = Quantified target compound.

Table I-04. Target compounds quantified in large-scale Experiments C-1 through C-3. Toxic Air Contaminant (TAC) Category for June 1996 is indicated where applicable.

Compound	TAC Cat.	Group	Table Abbrev.	Sources
Aromatic Hydrocarbons				
Styrene	I	1		CP4
4-Phenylcyclohexene		1	4-PCH	CP4
Other Hydrocarbons				
4-Ethenylcyclohexene		1	4-VCH	CP4
Halogenated Compounds				
1,2-Dichlorobenzene		1	1,2-DCB	CC4
Carbonyl Compounds				
Formaldehyde	I	Ald		No dominant src.
Acetaldehyde	I	Ald		No dominant src.
Other Oxidized Cmpds				
Di(propylene glycol)methyl ethers		1	DPGME	CP4
Phenol	I	1		CP4,CC4
Phenethyl alcohol		1	Phen alc	CP4
1-Decanol		2	Decanol	CP4
2,6-Di- <i>tert</i> -butyl-4-methylphenol		2	BHT	CC4
Nitrogen-Containing Cmpds				
N,N-Dimethylacetamide		2	DMA	CP4
N,N-Dimethylbenzylamine		2	BDMA	CC4
2,2'-Azobisisobutyronitrile		2	AIBN	CC4
2-Methyleneglutaronitrile		2	MeGlutN	CP4

Table I-05. Concentrations of Group 1 target VOCs for large-scale Experiment C-1.

Sample ID	Styrene	4-PCH	4-VCH	Chamber Concentration, $\mu\text{g m}^{-3}$ 1,2-DCB	DPGME	Phenol	Phen alc
Avg. Inlet	<1	<1	<1	<1	<3	<1	<1
Backgrnd.	<1	<1	<1	<1	<3	1	<1
1-h	11	9	14	2	28	5	1
3-h	9	8	13	2	24	4	1
6-h	11	10	19	3	24	4	1
24-h	6	12	9	4	19	3	1
48a-h	3	12	5	4	10	3	1
48b-h	4	13	6	4	13	4	1
72-h	2	11	3	3	9	3	1
96-h	2	10	2	3	9	3	1
120-h	1	9	2	3	6	2	<1
144-h	1	10	1	2	5	2	<1
168-h	1	9	1	2	6	2	<1
192a-h	<1	9	1	2	6	2	<1
192b-h	1	8	1	2	5	2	<1
216-h	<1	8	1	1	4	2	<1
240-h	<1	7	<1	1	4	2	<1
336-h	<1	6	<1	1	3	2	<1

Table I-06. Concentrations of Group 2 target VOCs for large-scale Experiment C-1.

Sample ID	Decanol	BHT	Chamber Concentration, $\mu\text{g m}^{-3}$				MeGlutN
			DMA	BDMA	AIBN		
Avg. Inlet	<1	<1	<10	<1	<1	<1	
Backgrnd.	<1	<1	<10	<1	<1	<1	
1-h	2	6	21	6	21	9	
3-h	2	4	17	8	22	8	
6-h	2	4	14	8	29	8	
24-h	3	3	10	7	43	6	
48a-h	2	3	<10	7	43	5	
48b-h	3	3	<10	7	47	6	
72-h	2	4	<10	8	39	5	
96-h	3	4	<10	7	40	4	
120-h	2	4	<10	4	32	2	
144-h	2	4	<10	5	31	2	
168-h	2	6	<10	7	30	2	
192a-h	2	6	<10	5	27	2	
192b-h	2	6	<10	5	25	2	
216-h	2	6	<10	5	22	1	
240-h	1	7	<10	4	20	1	
336-h	1	8	<10	<1	14	1	

Table I-07. Concentrations of Group 1 target VOCs for large-scale Experiment C-2.

Sample ID	Styrene	4-PCH	4-VCH	1,2-DCB	DPGME	Phenol	Phen alc
Avg. Inlet	<1	<1	<1	<1	<3	<1	<1
Backgrnd.	<1	<1	<1	<1	<3	1	<1
1-h	8	7	7	1	21	5	1
3-h	10	9	10	1	19	4	1
6-h	10	10	10	1	20	4	1
24-h	3	9	3	1	9	3	1
48a-h	1	6	2	1	4	2	1
48b-h	1	6	1	1	3	2	1
72-h	1	6	1	1	3	2	<1
96-h	2	9	3	2	9	2	<1
120-h	1	9	2	2	6	2	<1
144-h	1	9	1	1	6	2	<1
168-h	1	9	1	1	6	3	<1
192-h	1	9	1	1	6	3	<1
216-h	1	9	1	1	5	3	<1
240a-h	<1	8	1	1	5	2	<1
240b-h	1	8	1	1	5	2	<1
336-h	<1	7	<1	1	4	2	<1

Table I-08. Concentrations of Group 2 target VOCs for large-scale Experiment C-2.

Sample ID	Decanol	BHT	Chamber Concentration, $\mu\text{g m}^{-3}$			MeGlutN
			DMA	BDMA	AIBN	
Avg. Inlet	<1	<1	<10	<1	<1	<1
Backgrnd.	<1	<1	<10	<1	<1	<1
1-h	2	7	<10	9	12	9
3-h	3	5	<10	3	13	8
6-h	3	5	<10	4	17	7
24-h	2	3	<10	3	19	6
48a-h	2	3	<10	1	15	3
48b-h	2	3	<10	<1	13	3
72-h	2	3	<10	2	13	3
96-h	2	5	<10	3	22	3
120-h	2	6	<10	2	21	3
144-h	2	6	<10	3	20	2
168-h	3	9	<10	<1	19	2
192-h	2	9	<10	2	18	2
216-h	3	10	<10	<1	17	2
240a-h	2	11	<10	1	14	2
240b-h	2	11	<10	1	14	2
336-h	2	11	<10	<1	10	1

Table I-09. Concentrations of Group 1 target VOCs for large-scale Experiment C-3.

Sample ID	Styrene	4-PCH	4-VCH	1,2-DCB	DPGME	Phenol	Phen alc
Avg. Inlet	<1	<1	<1	<1	<3	<1	<1
Backgrnd.	<1	<1	<1	<1	<3	1	<1
1-h	1	3	1	<1	3	1	<1
3-h	1	4	2	<1	3	1	<1
6-h	1	6	3	<1	6	2	<1
24-h	1	8	3	<1	6	2	<1
48a-h	1	8	2	<1	4	2	<1
48b-h	1	9	2	<1	5	2	<1
72-h	1	9	1	<1	4	2	<1
96-h	1	9	1	<1	4	2	<1
120-h	<1	8	1	<1	3	2	<1
144-h	<1	8	1	<1	<3	2	<1
168-h	<1	7	<1	<1	<3	1	<1
192a-h	<1	7	<1	<1	<3	1	<1
192b-h	<1	7	<1	<1	<3	1	<1
216-h	<1	6	<1	<1	<3	1	<1
240a-h	<1	6	<1	<1	<3	1	<1
240b-h	<1	7	<1	<1	<3	2	<1
336-h	<1	5	<1	<1	<3	1	<1

Table I-10. Concentrations of Group 2 target VOCs for large-scale Experiment C-3.

Sample ID	Decanol	BHT	Chamber Concentration, $\mu\text{g m}^{-3}$				MEGlutN
			DMA	BDMA	AIBN		
Avg. Inlet	<1	<1	<10	<1	<1	<1	
Backgrnd.	<1	<1	<10	<1	<1	<1	
1-h	1	4	<10	<1	<1	1	
3-h	1	2	<10	<1	<1	1	
6-h	1	3	<10	<1	1	2	
24-h	1	2	<10	<1	1	2	
48a-h	1	2	<10	<1	1	2	
48b-h	2	2	<10	<1	1	2	
72-h	2	3	<10	<1	1	2	
96-h	2	3	<10	<1	1	1	
120-h	1	3	<10	<1	<1	1	
144-h	<1	4	<10	<1	<1	1	
168-h	1	4	<10	<1	<1	1	
192a-h	<1	5	<10	<1	<1	1	
192b-h	1	5	<10	<1	<1	1	
216-h	1	5	<10	<1	<1	<1	
240a-h	1	6	<10	<1	<1	<1	
240b-h	<1	6	<10	<1	<1	<1	
336-h	<1	7	<10	<1	<1	<1	

Table I-11. Concentrations of TVOC for large-scale Experiments C-1 through C-3.

Sample ID	Chamber Concentration, $\mu\text{g m}^{-3}$		
	Exp C-1	Exp C-2	Exp C-3
Avg. Inlet*	69 \pm 20	67 \pm 14	42 \pm 21
Background	117	106	121
1-h	746	494	276
3-h	700	537	264
6-h	741	574	349
24-h	797	442	409
48a-h	781	369	415
48b-h	812	367	473
72-h	781	349	420
96-h	753	593	368
120-h	631	622	335
144-h	706	655	358
168-h	732	700	316
192a-h	666	680	286
192b-h	696	---	317
216-h	567	653	269
240a-h	474	673	317
240b-h	---	662	332
336-h	429	494	255

*Average \pm 1 standard deviation.

Table I-12. Concentrations of SigmaVOC (*i.e.*, sum of 13 target VOCs) for large-scale Experiments C-1 through C-3.

Sample ID	Chamber Concentration, $\mu\text{g m}^{-3}$		
	Exp C-1	Exp C-2	Exp C-3
Avg. Inlet	<24	<24	<24
Background	<24	<24	<24
1-h	134	85	<24
3-h	121	87	<24
6-h	135	93	24
24-h	126	66	26
48a-h	99	44	<24
48b-h	103	42	25
72-h	91	40	24
96-h	87	67	24
120-h	67	62	<24
144-h	65	59	<24
168-h	69	63	<24
192a-h	62	60	<24
192b-h	55	---	<24
216-h	53	58	<24
240a-h	49	54	<24
240b-h	---	54	<24
336-h	36	45	<24

Table I-13. Concentrations of formaldehyde and acetaldehyde for large-scale Experiment C-1.
Formaldehyde and acetaldehyde were not measured for Experiments C-2 and C-3.

Sample ID	Chamber Concentration, $\mu\text{g m}^{-3}$	
	Formaldehyde	Acetaldehyde
Avg. Inlet*	1 ± 1	2 ± 1
Background	5	8
1-h	4	9
3-h	md**	md
6-h	6	12
24-h	4	9
48-h	7	12
72-h	5	11
96-h	6	10
120-h	4	9
144-h	4	8
168-h	5	10
192-h	5	10
216-h	4	8
240-h	2	7
336-h	4	6

*Average ± 1 standard deviation.

**md = Missing data; sample was not collected.

Table I-14. Quasi steady-state specific emission rates of Group 1 target VOCs for large-scale Experiment C-1.

Sample ID	Styrene	4-PCH	Specific Emission Rate, $\mu\text{g m}^{-2} \text{h}^{-1}$				Phenol	Phen alc
			4-VCH	1,2-DCB	DPGME			
1-h	54	42	68	8	136		18	6
3-h	11	10	16	2	30		3	1
6-h	13	12	23	3	29		4	1
24-h	7	15	11	5	23		3	1
48-h	4	16	7	5	14		3	1
72-h	2	14	4	4	11		3	1
96-h	2	12	3	4	11		2	1
120-h	1	11	2	3	7		1	<1
144-h	1	12	1	3	6		2	<1
168-h	1	12	1	2	8		2	<1
192-h	<1	11	1	2	7		2	<1
216-h	<1	10	1	2	5		1	<1
240-h	<1	9	<1	2	5		1	<1
336-h	<1	7	<1	1	4		1	<1

Table I-15. Quasi steady-state specific emission rates of Group 2 target VOCs for large-scale Experiment C-1.

Sample ID	Decanol	BHT	Specific Emission Rate, $\mu\text{g m}^{-2} \text{h}^{-1}$			AIBN	MeGlutN
			DMA	BDMA			
1-h	9	31	103	31		101	45
3-h	2	5	21	10		26	9
6-h	2	5	17	10		36	9
24-h	4	3	12	8		52	8
48-h	3	3	<12	9		55	7
72-h	3	4	<12	10		48	6
96-h	4	4	<12	9		49	5
120-h	3	5	<12	5		39	3
144-h	2	5	<12	6		39	3
168-h	2	7	<12	8		37	3
192-h	3	8	<12	7		31	2
216-h	2	7	<12	6		27	1
240-h	2	9	<12	5		24	1
336-h	1	10	<12	<1		17	1

Table I-16. Quasi steady-state specific emission rates of Group 1 target VOCs for large-scale Experiment C-2.

Sample ID	Styrene	4-PCH	Specific Emission Rate, $\mu\text{g m}^{-2} \text{h}^{-1}$ 4-VCH	Specific Emission Rate, $\mu\text{g m}^{-2} \text{h}^{-1}$ 1,2-DCB	DPGME	Phenol	Phen alc
1-h	103	89	83	9	262	47	15
3-h	49	40	48	5	87	13	5
6-h	46	47	47	6	94	13	6
24-h	14	44	16	6	44	9	4
48-h	6	30	7	4	16	4	3
72-h	4	30	5	3	16	3	<2
96-h	2	10	3	2	10	1	<1
120-h	1	10	2	2	8	1	<1
144-h	1	10	2	2	7	1	<1
168-h	1	11	1	2	7	2	<1
192-h	1	11	1	1	7	2	<1
216-h	1	11	1	1	6	2	<1
240-h	<1	10	1	1	5	1	<1
336-h	<1	8	<1	1	5	1	<1

Table I-17. Quasi steady-state specific emission rates of Group 2 target VOCs for large-scale Experiment C-2.

Sample ID	Decanol	BHT	Specific Emission Rate, $\mu\text{g m}^{-2} \text{ h}^{-1}$			MeGlutN
			DMA	BDMA	AIBN	
1-h	31	87	<123	109	148	110
3-h	12	22	<49	13	63	36
6-h	12	23	<49	18	79	35
24-h	11	16	<49	16	89	27
48-h	9	13	<49	3	66	15
72-h	10	15	<49	7	59	14
96-h	3	6	<12	4	26	3
120-h	3	7	<12	3	25	3
144-h	3	7	<12	3	24	3
168-h	4	10	<12	<1	23	3
192-h	3	11	<12	2	22	2
216-h	3	12	<12	<1	21	2
240-h	3	13	<12	1	17	2
336-h	2	14	<12	<1	11	1

Table I-18. Quasi steady-state specific emission rates of Group 1 target VOCs for large-scale Experiment C-3.

Sample ID	Styrene	4-PCH	Specific Emission Rate, $\mu\text{g m}^{-2} \text{h}^{-1}$ 4-VCH	1,2-DCB	DPGME	Phenol	Phen alc
1-h	5	15	5	<5	14	<5	<5
3-h	1	5	2	<1	4	1	<1
6-h	1	8	4	<1	7	1	<1
24-h	1	10	3	<1	7	1	<1
48-h	1	11	2	<1	6	1	<1
72-h	1	11	2	<1	5	1	<1
96-h	1	11	1	<1	5	1	<1
120-h	<1	10	1	<1	4	1	<1
144-h	1	9	1	<1	2	1	<1
168-h	<1	8	1	<1	2	<1	<1
192-h	<1	8	<1	<1	2	<1	<1
216-h	<1	8	<1	<1	2	<1	<1
240-h	<1	8	<1	<1	2	1	<1
336-h	<1	6	<1	<1	1	<1	<1

Table I-19. Quasi steady-state specific emission rates of Group 2 target VOCs for large-scale Experiment C-3.

Sample ID	Decanol	BHT	Specific Emission Rate, $\mu\text{g m}^{-2} \text{h}^{-1}$			MeGlutN
			DMA	BDMA	AIBN	
1-h	5	20	<49	<5	<5	6
3-h	1	2	<12	<1	<1	2
6-h	2	3	<12	<1	1	2
24-h	2	2	<12	<1	1	2
48-h	2	3	<12	<1	1	2
72-h	2	3	<12	<1	1	2
96-h	2	4	<12	<1	1	2
120-h	2	4	<12	<1	<1	1
144-h	1	5	<12	<1	<1	1
168-h	1	4	<12	<1	<1	1
192-h	1	6	<12	<1	<1	1
216-h	1	6	<12	<1	<1	<1
240-h	1	7	<12	<1	<1	<1
336-h	<1	8	<12	<1	<1	<1

Table I-20. Quasi steady-state specific emission rates of TVOC for large-scale Experiments C-1 through C-3.

Sample ID	Specific Emission Rate, $\mu\text{g m}^{-2} \text{h}^{-1}$		
	Exp C-1	Exp C-2	Exp C-3
1-h	3,040	4,850	748
3-h	715	2,020	175
6-h	765	2,200	280
24-h	834	1,570	353
48-h	834	1,230	396
72-h	815	1,140	367
96-h	781	585	303
120-h	630	621	263
144-h	722	660	291
168-h	754	714	240
192-h	692	689	221
216-h	553	657	182
240-h	439	675	250
336-h	383	467	164

Table I-21. Cumulative masses (milligrams) of target VOCs and TVOC emitted over 0 - 336 hours in large-scale Experiments C-1 through C-3.

Compound	Cumulative Mass, mg		
	Exp C-1	Exp C-2	Exp C-3
Aromatic Hydrocarbons			
Styrene	7	16	<4
4-Phenylcyclohexene	39	59	30
Other Hydrocarbons			
4-Ethenylcyclohexene	12	18	<4
Halogenated Compounds			
1,2-Dichlorobenzene	9	8	<4
Other Oxidized Cmpds			
Di(propylene glycol)methyl ethers	34	52	12
Phenol	7	10	<4
Phenethyl alcohol	<4	4	<4
1-Decanol	9	17	4
2,6-Di- <i>tert</i> -butyl-4-methylphenol	23	44	18
Nitrogen-Containing Cmpds			
N,N-Dimethylacetamide	<43	<43	<43
N,N-Dimethylbenzylamine	22	16	<4
2,2'-Azobisisobutyronitrile	123	115	<4
2-Methyleneglutaronitrile	13	26	4
TVOC	2,260	2,960	931

Table I-22. Cumulative exposures (ppb-hour) to target VOCs during the first 48 hours of large-scale Experiments C-1 through C-3. Estimates assume 20 hours of occupancy per day.

Compound	Cumulative Exposure, ppb-hour		
	Exp C-1	Exp C-2	Exp C-3
Aromatic Hydrocarbons			
Styrene	64	43	<9
4-Phenylcyclohexene	70	53	46
Other Hydrocarbons			
4-Ethenylcyclohexene	95	43	22
Halogenated Compounds			
1,2-Dichlorobenzene	24	8	<7
Other Oxidized Cmpds			
Di(propylene glycol)methyl ethers	111	66	32
Phenol	37	33	17
Phenethyl alcohol	<8	<8	<8
1-Decanol	16	14	8
2,6-Di- <i>tert</i> -butyl-4-methylphenol	14	17	10
Nitrogen-Containing Cmpds			
N,N-Dimethylacetamide	127	<112	<112
N,N-Dimethylbenzylamine	45	21	<7
2,2'-Azobisisobutyronitrile	230	99	<6
2-Methyleneglutaronitrile	60	52	16

Table I-23. Cumulative exposures (ppb-hour) to target VOCs over 48 - 336 hours in large-scale Experiments C-1 through C-3. Estimates assume 20 hours of occupancy per day.

Compound	Cumulative Exposure, ppb-hour		
	Exp C-1	Exp C-2	Exp C-3
Aromatic Hydrocarbons			
Styrene	<56	<56	<56
4-Phenylcyclohexene	318	301	259
Other Hydrocarbons			
4-Ethenylcyclohexene	60	60	<54
Halogenated Compounds			
1,2-Dichlorobenzene	77	45	<40
Other Oxidized Cmpds			
Di(propylene glycol)methyl ethers	198	187	<109
Phenol	137	139	94
Phenethyl alcohol	<48	<48	<48
1-Decanol	70	86	<37
2,6-Di- <i>tert</i> -butyl-4-methylphenol	152	223	122
Nitrogen-Containing Cmpds			
N,N-Dimethylacetamide	<675	<675	<675
N,N-Dimethylbenzylamine	214	75	<43
2,2'-Azobisisobutyronitrile	954	572	<36
2-Methyleneglutaronitrile	120	112	<55

APPENDIX J

EXPOSURE REDUCTION EXPERIMENTS WITH THE VINYL FLOORING ASSEMBLY

Appendix J presents the analytical data for the four large-scale exposure reduction experiments with the vinyl flooring assembly. The experiments were conducted in 25.5 m³ chamber compartments over a period of 336 hours. The 10.4-m² floor area was covered with Sheet Vinyl SV5. The concentrations of selected compounds and TVOC were measured throughout the experiments. Specific emission rates of these components were calculated. Cumulative mass emissions and cumulative exposures were estimated.

List of Tables

	<u>Page</u>
Table J-01. Summary of environmental parameters for large-scale Experiments V-1 through V-4 with sheet vinyl flooring materials.	395
Table J-02. Sheet vinyl flooring materials and quantities used in large-scale Experiments V-1 through V-4.	396
Table J-03. VOCs emitted by sheet vinyl flooring assembly in large-scale Experiment V-4 at 24- and 240-hours elapsed times.	397
Table J-04. Target compounds quantified in large-scale Experiments V-1 through V-4.	400
Table J-05. Concentrations of Group 1 target VOCs for large-scale Experiment V-1.	401
Table J-06. Concentrations of Group 2 target VOCs for large-scale Experiment V-1.	402
Table J-07. Concentrations of Group 1 target VOCs for large-scale Experiment V-4.	403
Table J-08. Concentrations of Group 2 target VOCs for large-scale Experiment V-4.	404
Table J-09. Concentrations of Group 1 target VOCs for large-scale Experiment V-2.	405
Table J-10. Concentrations of Group 2 target VOCs for large-scale Experiment V-2.	406
Table J-11. Concentrations of Group 1 target VOCs for large-scale Experiment V-3.	407
Table J-12. Concentrations of Group 2 target VOCs for large-scale Experiment V-3.	408
Table J-13. Concentrations of TVOC for large-scale Experiments V-1 through V-4.	409
Table J-14. Concentrations of SigmaVOC for large-scale Experiments V-1 through V-4.	410
Table J-15. Concentrations of formaldehyde for large-scale Experiments V-1 through V-4.	411
Table J-16. Concentrations of acetaldehyde for large-scale Experiments V-1 through V-4.	412
Table J-17. Quasi steady-state specific emission rates of Group 1 target VOCs for large-scale Experiment V-1.	413
Table J-18. Quasi steady-state specific emission rates of Group 2 target VOCs for large-scale Experiment V-1.	414
Table J-19. Quasi steady-state specific emission rates of Group 1 target VOCs for large-scale Experiment V-4.	415
Table J-20. Quasi steady-state specific emission rates of Group 2 target VOCs for large-scale Experiment V-4.	416
Table J-21. Quasi steady-state specific emission rates of Group 1 target VOCs for large-scale Experiment V-2.	417
Table J-22. Quasi steady-state specific emission rates of Group 2 target VOCs for large-scale Experiment V-2.	418
Table J-23. Quasi steady-state specific emission rates of Group 1 target VOCs for large-scale Experiment V-3.	419
Table J-24. Quasi steady-state specific emission rates of Group 2 target VOCs for large-scale Experiment V-3.	420
Table J-25. Quasi steady-state specific emission rates of TVOC for large-scale Experiments V-1 through V-4.	421
Table J-26. Quasi steady-state specific emission rates of formaldehyde for large-scale Experiments V-1 through V-4.	422
Table J-27. Quasi steady-state specific emission rates of acetaldehyde for large-scale Experiments V-1 through V-4.	423

List of Tables, Continued

	<u>Page</u>
Table J-28. Cumulative masses of target compounds and TVOC emitted over 0 - 336 hours in large-scale Experiments V-1 through V-4.	424
Table J-29. Cumulative exposures to target compounds during the first 48 hours of large-scale Experiments V-1 through V-4.....	425
Table J-30. Cumulative exposures to target compounds over 48 - 336 hours in large-scale Experiments V-1 through V-4.....	426

Table J-01. Summary of environmental parameters for large-scale Experiments V-1 through V-4 with sheet vinyl flooring materials.

Parameter	Experiment			
	V-1*	V-4	V-2	V-3
Starting date	08/07/97	10/21/97	08/14/97	09/15/97
Treatment	Base case	Base case	Add ventilation	Air out SV, CB
Ventilation rate, 2 - 72 h (h⁻¹)				
Average \pm 1 std. dev.	0.48 \pm 0.01 [†]	0.50 \pm 0.01 [†]	1.93 \pm 0.01 [‡]	0.49 \pm 0.01 [†]
Range	0.48 - 0.49	0.49 - 0.51	1.09 - 1.97	0.48 - 0.49
Ventilation rate, 72 - 336 h (h⁻¹)				
Average \pm 1 std. dev.	0.49 \pm 0.01	0.50 \pm 0.01	0.50 \pm 0.01	0.48 \pm 0.01
Range	0.47 - 0.49	0.49 - 0.50	0.49 - 0.50	0.48 - 0.49
Temperature (°C)				
Average \pm 1 std. dev.	23.5 \pm 1.0	23.1 \pm 0.9	24.1 \pm 0.9	24.0 \pm 1.1
Range	21.7 - 26.8	21.4 - 25.1	22.0 - 26.2	21.5 - 26.3
Relative Humidity (%)				
Average \pm 1 std. dev.	55 \pm 2	50 \pm 6	56 \pm 3	49 \pm 4
Range	52 - 61	40 - 62	49 - 61	39 - 57

*Statistics were calculated for first 144 hours only.

[†]Ventilation rate for 0 - 2 hours was 2 h⁻¹.[‡]Ventilation rate for 0 - 2 hours was 5 h⁻¹.

Table J-02. Sheet vinyl flooring materials and quantities used in large-scale Experiments V-1 through V-4. See Appendix E, Table E-01, for complete material descriptions.

Material Description	Material ID	Unit of Measure	Quantity			
			Exp V-1	Exp V-4	Exp V-2	Exp V-3
Particle board underlayment	UL	m ²	10.4	10.4	10.4	10.4
Residential sheet vinyl*	SV5	m ²	10.4	10.4	10.4	10.4
Rubber cove base, 4" wide	CB	m	12.5	12.5	12.5	12.5
Sheet flooring adhesive	SFA	kg	2.73	3.40	2.95	2.97
Cove base adhesive	CBA	kg	0.51	0.47	0.50	0.48
Seam sealer	SS	mL	15	15	15	15

*Area of sheet vinyl was used in specific emission rate calculations.

Table J-03. VOCs emitted by sheet vinyl flooring assembly in large-scale Experiment V-4 at 24- and 240-hours elapsed times.

COMPOUND	Code*	RT (min)	24-h ET	240-h ET	Match Quality
Alkane Hydrocarbons					
C7 Branched alkane HC		9.4	+		Probable
n-Octane		10.9	+	+	Confirmed
n-Nonane		15.2	+	+	Confirmed
C10 Branched alkane HC		16.6	+	+	Probable
C10 Branched alkane HC		17.6	+	+	Probable
C10 Branched alkane HC		17.7	+	+	Probable
C10 Branched alkane HC		18.1	+	+	Probable
n-Decane	A,Q	19.2	+	+	Confirmed
C11 Branched alkane HC		20.0	+	+	Probable
C11 Branched alkane HC		21.3	+	+	Probable
C11 Branched alkane HC		21.4	+	+	Probable
C11 Branched alkane HC		21.5	+	+	Probable
C11 Branched alkane HC		21.7	+	+	Probable
n-Undecane		22.8	+	+	Confirmed
n-Dodecane	B,Q	26.2	+	+	Confirmed
n-Tridecane	A,B,Q	29.3	+	+	Confirmed
n-Tetradecane	A,B,Q	32.2	+	+	Confirmed
n-Pentadecane		35.0	+	+	Confirmed
Aromatic Hydrocarbons					
Toluene	T,A,Q	11.7	+	+	Confirmed
m-,p-Xylene	T,Q	16.1	+	+	Confirmed
o-Xylene	T	17.3	+	+	Confirmed
Styrene	T,Q	17.6	+	+	Confirmed
Propylbenzene		19.5	+	+	Confirmed
Ethyltoluene isomer		19.7	+	+	Probable
4-Ethyltoluene		19.8	+	+	Confirmed
C3 Alkylbenzene		20.0	+	+	Probable
2-Ethyltoluene		20.6	+	+	Confirmed
1,2,4-Trimethylbenzene	T,Q	21.2	+	+	Confirmed
C4 Alkylbenzene		21.8	+	+	Probable
C4 Alkylbenzene		22.0	+	+	Probable
1,2,3-Trimethylbenzene		22.4	+	+	Confirmed
1,3-Diethylbenzene		22.9	+	+	Confirmed
C4 Alkylbenzene		23.0	+	+	Probable
C4 Alkylbenzene		23.1	+	+	Probable
C4 Alkylbenzene		23.2	+	+	Probable
C4 Alkylbenzene		23.7	+	+	Probable
C4 Alkylbenzene		24.0	+	+	Probable
C4 Alkylbenzene		24.1	+	+	Probable
C4 Alkylbenzene		24.3	+	+	Probable
C5 Alkylbenzene		24.6	+	+	Probable
Butenylbenzene isomer		24.6	+	+	Probable
1,2,3,5-Tetramethylbenzene		25.7	+	+	Confirmed
C6 Alkylbenzene		26.9	+		Probable

Table J-03, Continued. VOCs emitted by sheet vinyl flooring assembly in large-scale Experiment V-4 at 24- and 240-hours elapsed times.

COMPOUND	Code*	RT (min)	24-h ET	240-h ET	Match Quality
Aromatic Hydrocarbons, Cont.					
C4 Alkylbenzene	T	27.0	+	+	Probable
C6 Alkylbenzene		27.8	+		Probable
Naphthalene		29.5	+		Confirmed
C2 Tetrahydronaphthalene		32.3	+	+	Probable
C2 Tetrahydronaphthalene		32.5	+	+	Probable
C2 Tetrahydronaphthalene		32.9	+	+	Probable
(1-Butylhexyl)benzene		37.1	+	+	Probable
(1-Propylheptyl)benzene		37.4	+	+	Probable
(1-Ethylloctyl)benzene		37.9	+	+	Probable
(1-Methylnonyl)benzene		39.0	+	+	Probable
(1-Phenylhexyl)benzene		39.4	+	+	Probable
(1-Butylheptyl)benzene		39.5	+	+	Probable
(1-Propylloctyl)benzene		39.8	+	+	Probable
(1-Ethylononyl)benzene		40.4	+	+	Probable
(1-Methyldecyl)benzene		41.5	+	+	Probable
(1-Penylheptyl)benzene		41.8	+	+	Probable
(1-Butylloctyl)benzene		41.9	+	+	Probable
(1-Propylononyl)benzene		42.2	+	+	Probable
Other Hydrocarbons					
Dimethylcyclohexane isomer		10.3	+		Probable
Trimethylcyclohexane isomer		13.6	+		Probable
C3 Alkyl substituted cyclohexane		15.1	+		Probable
Propylcyclohexane		16.9	+	+	Confirmed
C10 Alkene or cyclic HC		18.8	+	+	Probable
Butylcyclohexane		20.9	+	+	Confirmed
C11 Alkene HC		21.0	+	+	Probable
Alkene HC		28.8	+	+	Tentative
Alkene HC or cyclic HC		28.9	+	+	Tentative
Alkene HC or cyclic HC		29.0	+	+	Tentative
Alkene HC		29.4	+	+	Tentative
Alkene HC		30.0	+	+	Tentative
Alkene HC		30.3	+	+	Tentative
Alkene HC		37.1		+	Tentative
Carbonyl Compounds					
Hexanal	B	14.5		+	Confirmed
Cyclohexanone	A,Q	19.7	+	+	Confirmed
Benzaldehyde	B,Q	22.5	+	+	Confirmed
Nonanal	B	26.0	+	+	Confirmed
1-Phenylethanone	T	26.5	+		Confirmed
Other Oxidized Compounds					
Tetrahydrofuran	A,B,Q	6.2	+	+	Confirmed
1-Butanol		9.9	+		Confirmed

Table J-03, Continued. VOCs emitted by sheet vinyl flooring assembly in large-scale Experiment V-4 at 24- and 240-hours elapsed times.

COMPOUND	Code*	RT (min)	24-h ET	240-h ET	Match Quality
Other Oxidized Cmpds., Con't.					
Acetic acid	B	10.6	+	+	Confirmed
1-Octanol	Q	25.4	+	+	Confirmed
Benzyl alcohol	Q	26.5	+	+	Confirmed
Phenol	T,A,B,Q	26.6	+	+	Confirmed
2-Ethylhexanoic acid		28.4		+	Probable
2,2,4-Trimethyl-1,3-pentanediol monoisobutyrate (Texanol 1)	B	35.2	+	+	Confirmed
2,2,4-Trimethyl-1,3-pentanediol monoisobutyrate (Texanol 3)	B	35.6	+	+	Confirmed
1-Dodecanol		37.0		+	Confirmed
2,2,4-Trimethyl-1,3-pentanediol diisobutyrate (TXIB)	A,B,Q	40.3	+	+	Confirmed
Miscellaneous Compounds					
<i>tert</i> -Butyl isothiocyanate	Q	16.6	+	+	Confirmed
Octamethylcyclotetrasiloxane	B	18.2	+	+	Confirmed
Benzothiazole	A,Q	31.6	+	+	Confirmed
Unidentified Compounds					
Unidentified compound		29.1	+	+	Unident.

*T = Toxic air contaminant; A = Abundant compound; B = Component of chamber background;
Q = Quantified target compound.

Table J-04. Target compounds quantified in large-scale Experiments V-1 through V-4. Toxic Air Contaminant (TAC) Category for June 1996 is indicated where applicable.

Compound	TAC Cat.	Group	Table Abbrev.	Source(s)
Alkane Hydrocarbons				
n-Decane		1	n-C10	SV5,CBA
n-Dodecane		1	n-C12	SV5,CBA
n-Tridecane		1	n-C13	SV5,CB
n-Tetradecane		1	n-C14	SV5
Aromatic Hydrocarbons				
Toluene	I	1		SV5,CB,SFA,CBA
m-,p-Xylene	I	1	Xylenes	SV5,CBA
Styrene	I	1		CB,CBA
1,2,4-Trimethylbenzene	III	1	1,2,4-TMB	SV5
Carbonyl Compounds				
Formaldehyde	I	Ald		No dominant src.
Acetaldehyde	I	Ald		No dominant src.
Cyclohexanone		2	C-hexone	CB,SS
Benzaldehyde		2	Benzald	SV5,CB,SFA
Other Oxidized Cmpds.				
Tetrahydrofuran		2	THF	SS
1-Octanol		2	Octanol	SV5
Benzyl alcohol		2	Benz alc	SV5
Phenol	I	2		SV5
2,2,4-Trimethyl-1,3-pentanediol diisobutyrate		2	TXIB	SV5
Miscellaneous Cmpds.				
tert-Butylisothiocyanate		2	Butisothio	CB
Benzothiazole		2	Benzothiaz	CB

Table J-05. Concentrations of Group 1 target VOCs for large-scale Experiment V-1. Data subsequent to 144-hours elapsed time were invalid (see Report).

Sample ID	n-C10	n-C12	n-C13	Chamber Concentration, $\mu\text{g m}^{-3}$			Xylenes	Styrene	1,2,4-TMB
				n-C14	Toluene				
Avg. Inlet	<1	<1	<1	<1	1		<1	<1	<1
Background	<1	<1	<1	<1	1		<1	<1	<1
1-h	82	76	220	112	239		14	8	33
3-h	68	52	140	78	696		12	13	30
6-h	81	50	125	70	1,180		12	16	35
24-h	52	29	74	36	523		7	10	21
48-h	40	23	60	30	143		5	7	16
72a-h	39	23	63	30	130		5	6	17
72b-h	37	24	65	30	134		4	6	17
96-h	35	24	65	31	107		5	5	16
120-h	36	25	66	32	108		5	5	17
144-h	37	26	71	35	122		5	5	19

Table J-06. Concentrations of Group 2 target VOCs for large-scale Experiment V-1. Data subsequent to 144-hours elapsed time were invalid (see Report).

Sample ID	C-hexone	Benzald	THF	Chamber Concentration, µg m ⁻³			TXIB	Butisothio	Benzothiaz
				Octanol	Benz alc	Phenol			
Avg. Inlet	<1	<1	4	<1	<1	<1	<1	<1	<1
Background	<1	1	<1	<1	<1	1	<1	<1	<1
1-h	3,760	16	7,020	12	29	108	8	6	25
3-h	1,080	15	1,850	13	30	97	31	8	28
6-h	853	15	1,370	13	29	93	41	10	30
24-h	137	11	196	10	24	70	28	6	29
48-h	53	9	57	8	23	69	26	5	28
72a-h	39	9	49	8	23	72	28	3	28
72b-h	39	9	38	8	22	75	md*	3	29
96-h	31	9	35	8	26	75	31	3	29
120-h	29	9	43	8	25	74	32	3	27
144-h	29	10	44	10	26	79	38	3	29

*md = Missing data.

Table J-07. Concentrations of Group 1 target VOCs for large-scale Experiment V-4.

Sample ID	n-C10	n-C12	n-C13	Chamber Concentration, $\mu\text{g m}^{-3}$ n-C14	Toluene	Xylenes	Styrene	1,2,4-TMB
Avg. Inlet	<1	<1	<1	<1	1	<1	<1	<1
Background	1	<1	1	<1	1	<1	<1	<1
1-h	170	104	206	90	227	19	11	51
3-h	50	44	126	66	118	8	6	24
6-h	58	46	118	58	102	8	8	32
24-h	28	23	65	32	74	4	5	17
48-h	22	17	51	23	54	3	4	13
72a-h	24	16	47	22	59	3	3	12
72b-h	25	17	49	25	61	3	4	12
96-h	40	19	45	21	71	4	4	13
120-h	28	23	63	32	44	4	3	15
144-h	31	22	59	29	48	5	4	16
168-h	24	20	54	27	39	4	3	14
192-h	25	21	55	28	38	4	3	15
216-h	24	20	56	29	43	4	3	15
240a-h	25	19	57	30	41	3	3	15
240b-h	24	22	61	32	39	4	3	16
336a-h	19	15	45	24	29	3	2	11
336b-h	18	16	48	26	33	3	2	11

Table J-08. Concentrations of Group 2 target VOCs for large-scale Experiment V-4.

Sample ID	C-hexone	Benzald	THF	Octanol	Benz alc	Phenol	TXIB	Butisothio	Benzothiaz
Avg. Inlet	<1	<1	5	<1	<1	<1	<1	<1	<1
Background	<1	1	1	<1	<1	1	1	<1	<1
1-h	3,640	18	7,770	12	26	123	4	9	19
3-h	940	12	1,840	8	24	114	18	8	24
6-h	530	16	680	10	24	108	22	12	24
24-h	97	10	94	8	20	84	27	6	24
48-h	45	8	41	6	18	77	21	4	23
72a-h	28	8	38	5	16	73	25	3	23
72b-h	32	8	40	6	17	78	md*	3	24
96-h	24	6	54	5	14	60	20	3	18
120-h	25	10	30	8	23	91	38	3	27
144-h	24	9	28	8	22	83	32	3	25
168-h	18	8	21	7	20	76	29	3	22
192-h	18	8	23	8	21	76	28	2	21
216-h	16	8	20	7	19	71	35	2	19
240a-h	15	9	16	7	19	77	37	2	19
240b-h	15	8	20	8	22	79	34	2	20
336a-h	9	6	7	5	13	62	32	2	15
336b-h	9	5	9	5	16	68	31	1	15

*md = Missing data.

Table J-09. Concentrations of Group 1 target VOCs for large-scale Experiment V-2.

Sample ID	Chamber Concentration, $\mu\text{g m}^{-3}$							1,2,4-TMB
	n-C10	n-C12	n-C13	n-C14	Toluene	Xylenes	Styrene	
Avg. Inlet	<1	<1	<1	<1	1	<1	<1	<1
Background	<1	<1	1	<1	2	<1	<1	<1
1-h	16	18	85	53	20	4	2	10
3-h	23	18	60	35	42	4	3	12
6-h	23	20	61	34	29	3	3	14
24-h	10	9	30	15	12	1	2	6
48-h	12	11	37	20	15	2	2	7
72a-h	13	10	36	18	15	2	2	7
72b-h	11	9	31	17	16	2	2	7
96-h	26	20	51	25	38	3	4	14
120-h	28	20	53	26	42	5	4	15
144a-h	24	20	54	27	38	4	4	15
144b-h	26	21	54	26	36	4	4	15
168-h	24	18	51	26	36	4	4	14
192-h	24	20	57	30	37	4	4	14
216-h	24	19	55	27	32	4	3	15
240-h	26	19	54	29	34	3	3	15
336a-h	25	20	54	30	31	3	3	14
336b-h	25	18	49	27	31	3	3	14

Table J-10. Concentrations of Group 2 target VOCs for large-scale Experiment V-2.

Sample ID	C-hexone	Benzald	THF	Chamber Concentration, $\mu\text{g m}^{-3}$ Octanol	Benz alc	Phenol	TXIB	Butisothio	Benzothiaz
Avg. Inlet	<1	<1	12	<1	<1	<1	<1	<1	<1
Background	<1	1	2	<1	<1	1	<1	<1	<1
1-h	794	6	960	6	20	73	4	4	18
3-h	289	7	349	6	19	75	24	6	20
6-h	184	8	149	7	23	80	35	6	24
24-h	32	5	35	4	16	61	23	3	18
48-h	22	6	29	5	21	79	md*	3	26
72a-h	16	5	19	5	20	77	34	3	23
72b-h	15	5	19	5	19	73	28	3	22
96-h	26	9	22	7	20	62	24	6	22
120-h	25	9	23	8	22	64	30	7	24
144a-h	20	9	21	8	20	61	27	3	22
144b-h	20	9	24	8	21	62	22	5	21
168-h	17	8	13	8	21	62	29	3	21
192-h	16	8	18	9	20	67	33	3	23
216-h	15	8	18	8	18	62	31	2	20
240-h	15	8	14	7	18	55	30	4	19
336a-h	13	7	11	8	20	66	33	4	19
336b-h	13	7	10	7	18	56	30	4	17

*md = Missing data.

Table J-11. Concentrations of Group 1 target VOCs for large-scale Experiment V-3.

Sample ID	Chamber Concentration, $\mu\text{g m}^{-3}$							Styrene	Xylenes	1,2,4-TMB
	n-C10	n-C12	n-C13	n-C14	Toluene	Xylenes	Styrene			
Avg. Inlet	<1	<1	<1	<1	1	<1	<1	<1	<1	<1
Background	<1	<1	1	<1	1	<1	<1	<1	<1	<1
1-h	84	75	173	76	165	10	4	4	27	27
3-h	59	56	173	82	108	10	7	7	29	29
6-h	42	32	94	45	69	7	6	6	21	21
24-h	25	16	49	22	43	4	4	4	13	13
48-h	27	20	57	27	39	4	3	3	15	15
72a-h	25	19	52	25	31	3	2	2	14	14
72b-h	26	19	56	28	36	3	3	3	15	15
96-h	21	16	51	24	32	3	2	2	12	12
120-h	23	17	52	27	32	3	2	2	13	13
144a-h	25	20	58	29	35	3	3	3	14	14
144b-h	25	18	53	26	33	4	3	3	14	14
168-h	25	18	53	27	31	4	3	3	14	14
192-h	24	20	58	29	30	4	3	3	14	14
216-h	29	21	61	31	36	5	3	3	16	16
240a-h	25	20	61	33	38	4	3	3	15	15
240b-h	27	22	65	35	41	4	3	3	17	17
336-h	22	18	57	30	33	3	2	2	14	14

Table J-12. Concentrations of Group 2 target VOCs for large-scale Experiment V-3.

Sample ID	C-hexone	Benzald	THF	Octanol	Benz alc	Phenol	TXIB	Butisothio	Benzothiaz
Avg. Inlet	<1	<1	4	<1	<1	<1	<1	<1	<1
Background	<1	1	2	<1	<1	4	5	<1	1
1-h	2,620	10	6,450	6	10	41	4	2	10
3-h	863	13	2,140	7	20	72	20	7	16
6-h	598	11	1,230	7	13	48	20	7	11
24-h	88	8	130	6	13	43	18	6	13
48-h	46	9	72	7	18	59	24	5	18
72a-h	29	9	53	7	19	59	21	5	16
72b-h	32	8	37	7	18	61	md*	5	18
96-h	21	7	33	6	16	59	22	4	17
120-h	20	7	32	7	18	63	22	4	18
144a-h	18	8	28	8	20	65	31	4	18
144b-h	19	7	30	7	19	59	29	4	17
168-h	18	8	29	7	18	63	29	4	17
192-h	16	8	25	7	19	66	31	3	18
216-h	17	9	25	8	18	68	37	4	17
240a-h	15	7	24	7	19	65	37	3	16
240b-h	16	9	27	8	19	70	40	3	18
336-h	11	7	17	6	14	61	31	2	14

*md = Missing data.

Table J-13. Concentrations of TVOC for large-scale Experiments V-1 through V-4.

Sample ID	Chamber Concentration, $\mu\text{g m}^{-3}$			
	Exp V-1*	Exp V-4	Exp V-2	Exp V-3
--				
Avg. Inlet**	97 \pm 28	31 \pm 10	82 \pm 41	35 \pm 12
Background	168	81	174	98
1-h	7,620	8,840	2,140	6,260
3-h	4,090	2,920	1,890	2,330
6-h	4,530	2,260	1,350	2,090
24-h	2,040	1,220	1,060	1,070
48-h	1,610	967	924	1,080
72a-h	1,410	942	990	931
72b-h	1,270	980	1,150	958
96-h	1,330	1,180	963	931
120-h	1,440	1,170	1,180	931
144a-h	1,490	1,150	1,050	1,010
144b-h	---	---	1,030	980
168-h	---	1,030	990	1,000
192-h	---	997	960	1,010
216-h	---	1,070	1,000	1,140
240a-h	---	1,050	1,060	1,120
240b-h	---	1,050	---	1,200
336a-h	---	850	1,140	1,000
336b-h	---	870	1,060	---

*Data subsequent to 144-h elapsed time were invalid.

**Average \pm 1 standard deviation.

Table J-14. Concentrations of SigmaVOC (*i.e.*, sum of 17 target VOCs) for large-scale Experiments V-1 through V-4.

Sample ID	Chamber Concentration, $\mu\text{g m}^{-3}$			
	Exp V-1*	Exp V-4	Exp V-2	Exp V-3
Avg. Inlet	<17	<17	<17	<17
Background	<17	<17	<17	<17
1-h	11,800	12,500	2,090	9,770
3-h	4,250	3,440	994	3,680
6-h	4,040	1,860	702	2,270
24-h	1,270	622	282	502
48-h	609	433	298	451
72a-h	578	408	304	392
72b-h	547	408	284	373
96-h	541	425	378	350
120-h	551	469	405	364
144a-h	595	453	378	391
144b-h	---	---	381	370
168-h	---	390	362	373
192-h	---	396	386	376
216-h	---	395	362	409
240a-h	---	396	355	397
240b-h	---	411	---	429
336a-h	---	301	362	346
336b-h	---	321	334	---

*Data subsequent to 144-h elapsed time were invalid.

Table J-15. Concentrations of formaldehyde for large-scale Experiments V-1 through V-4.

Sample ID	Chamber Concentration, $\mu\text{g m}^{-3}$			
	Exp V-1*	Exp V-4	Exp V-2	Exp V-3
Avg. Inlet**	3.9 ± 0.9	2.1 ± 0.5	4.6 ± 1.8	4.1 ± 2.6
Background	9.3	5.3	4.1	7.0
1-h	14.3	10.1	5.0	10.5
3-h	19.5	12.0	7.8	18.5
6-h	21.3	11.4	7.4	15.1
24-h	12.2	6.4	4.4	9.7
48-h	11.6	5.8	4.4	7.2
72-h	11.2	5.6	4.5	10.8
96-h	10.2	6.4	7.6	10.5
120-h	10.0	7.7	9.5	9.8
144-h	9.0	5.9	10.7	10.0
168-h	---	4.5	10.5	10.4
192-h	---	7.2	11.4	11.4
216-h	---	8.5	13.8	12.6
240-h	---	6.1	16.5	12.4
336-h	---	6.7	12.2	13.6

*Data subsequent to 144-h elapsed time were invalid.

**Average \pm 1 standard deviation.

Table J-16. Concentrations of acetaldehyde for large-scale Experiments V-1 through V-4.

Sample ID	Chamber Concentration, $\mu\text{g m}^{-3}$			
	Exp V-1*	Exp V-4	Exp V-2	Exp V-3
Avg. Inlet**	6.7 ± 1.0	3.0 ± 0.7	3.6 ± 1.2	3.7 ± 1.5
Background	9.5	6.2	7.1	6.3
1-h	10.9	6.0	3.1	5.9
3-h	15.9	8.0	7.3	9.1
6-h	22.5	10.7	7.6	10.5
24-h	16.5	9.7	5.1	8.1
48-h	15.3	7.3	4.7	8.7
72-h	13.9	6.9	4.9	9.3
96-h	12.9	7.4	11.0	10.7
120-h	11.9	8.5	8.6	10.4
144-h	11.2	8.1	8.7	9.7
168-h	---	6.7	9.4	10.5
192-h	---	8.2	8.3	10.9
216-h	---	9.5	8.5	12.0
240-h	---	6.1	10.9	10.2
336-h	---	7.3	7.7	11.0

*Data subsequent to 144-h elapsed time were invalid.

**Average \pm 1 standard deviation.

413

Sample ID	Specific Emission Rate, $\mu\text{g m}^{-2} \text{h}^{-1}$					Styrene	1,2,4-TMB
	n-C10	n-C12	n-C13	n-C14	Toluene		
					Xylenes		
1-h	382	354	1,020	518	1,100	64	154
3-h	80	61	165	92	818	14	36
6-h	95	59	147	82	1,390	14	42
24-h	61	34	87	42	614	8	25
48-h	47	27	71	35	167	6	19
72-h	45	28	75	35	154	5	20
96-h	42	28	78	38	127	5	20
120-h	43	30	79	38	129	5	20
144-h	45	31	86	42	145	6	23

Table J-18. Quasi steady-state specific emission rates of Group 2 target VOCs for large-scale Experiment V-1. Data subsequent to 144-hours elapsed time were invalid (see Report).

Sample ID	C-hexone	Benzald	THF	Specific Emission Rate, $\mu\text{g m}^{-2} \text{h}^{-1}$				TXIB	Butisothio	Benzothiaz
				Octanol	Benz alc	Phenol				
1-h	17,400	73	32,500	55	136	500		36	27	118
3-h	1,270	17	2,160	15	36	114		37	9	33
6-h	1,000	18	1,600	15	34	109		48	12	35
24-h	162	13	227	12	28	83		33	7	34
48-h	62	11	63	9	27	82		31	5	32
72-h	46	11	48	9	26	86		32	4	34
96-h	38	11	40	10	31	90		37	4	35
120-h	35	11	47	10	30	89		38	4	32
144-h	35	13	49	12	31	95		46	4	35

Table J-19. Quasi steady-state specific emission rates of Group 1 target VOCs for large-scale Experiment V-4.

Sample ID	n-C10	n-C12	n-C13	Specific Emission Rate, $\mu\text{g m}^{-2} \text{h}^{-1}$				Xylenes	Styrene	1,2,4-TMB
				n-C14	Toluene					
1-h	823	501	993	433	1,090	93	51	246		
3-h	61	54	154	81	143	10	7	29		
6-h	71	56	145	71	124	10	10	39		
24-h	34	28	80	39	89	5	6	21		
48-h	27	21	63	28	65	4	5	16		
72-h	30	20	59	28	73	4	4	14		
96-h	50	23	56	25	86	5	5	16		
120-h	34	28	78	39	53	5	4	18		
144-h	38	26	73	36	58	6	5	19		
168-h	29	24	66	34	46	5	4	17		
192-h	31	25	67	35	46	4	4	18		
216-h	29	25	69	36	51	5	3	19		
240-h	30	25	72	38	48	4	3	19		
336-h	23	19	57	31	37	3	2	14		

Table J-20. Quasi steady-state specific emission rates of Group 2 target VOCs for large-scale Experiment V-4.

Sample ID	C-hexone	Benzald	THF	Specific Emission Rate, $\mu\text{g m}^{-2} \text{h}^{-1}$			TXIB	Butisothio	Benzothiaz
				Octanol	Benz alc	Phenol			
1-h	17,600	85	37,400	59	127	594	17	42	93
3-h	1,150	15	2,250	10	29	140	22	10	29
6-h	650	20	808	12	29	132	27	15	29
24-h	119	12	113	10	25	103	33	7	29
48-h	55	10	48	7	22	94	26	5	28
72-h	37	9	46	7	20	93	31	4	28
96-h	29	7	64	6	17	73	24	3	22
120-h	31	12	33	9	29	111	46	4	33
144-h	30	11	31	10	27	102	39	4	30
168-h	22	10	22	8	24	93	36	3	27
192-h	22	10	25	9	25	93	34	3	25
216-h	20	10	20	8	23	87	43	2	24
240-h	18	11	18	9	25	95	43	2	24
336-h	11	7	9	6	18	80	38	2	19

Table J-21. Quasi steady-state specific emission rates of Group 1 target VOCs for large-scale Experiment V-2.

Sample ID	Specific Emission Rate, $\mu\text{g m}^{-2} \text{h}^{-1}$					Xylenes	Styrene	1,2,4-TMB
	n-C10	n-C12	n-C13	n-C14	Toluene			
1-h	192	216	1,010	623	228	48	24	120
3-h	110	86	282	167	196	19	14	57
6-h	108	96	287	159	135	16	16	68
24-h	48	41	140	73	53	6	10	29
48-h	57	51	175	92	69	10	10	35
72-h	57	46	158	82	68	9	9	35
96-h	31	24	63	31	45	4	5	17
120-h	34	25	64	32	51	6	5	19
144-h	31	24	66	32	44	5	5	19
168-h	30	22	63	32	43	5	4	17
192-h	29	25	70	37	44	4	4	17
216-h	29	24	67	33	38	4	4	18
240-h	32	24	66	35	41	4	4	18
336-h	31	24	63	35	37	4	3	17

Table J-22. Quasi steady-state specific emission rates of Group 2 target VOCs for large-scale Experiment V-2.

Sample ID	C-hexone	Benzald	THF	Specific Emission Rate, $\mu\text{g m}^{-2} \text{h}^{-1}$			TXIB	Butisothio	Benzothiaz
				Octanol	Benz alc	Phenol			
1-h	9,420	72	10,400	72	240	863	48	24	216
3-h	1,370	33	1,270	29	91	354	115	14	96
6-h	868	40	326	32	108	378	163	16	112
24-h	150	25	142	19	76	287	108	6	86
48-h	105	29	118	22	99	373	134	10	124
72-h	74	25	76	22	91	355	147	6	106
96-h	31	11	24	8	25	76	30	4	26
120-h	31	11	24	10	27	79	37	4	29
144-h	25	11	19	10	24	75	30	3	26
168-h	21	10	10	9	26	76	36	3	25
192-h	19	10	16	11	25	82	40	3	28
216-h	18	10	12	9	22	76	38	2	25
240-h	18	10	14	9	22	67	37	2	23
336-h	16	9	7	9	23	75	39	2	22

Table J-23. Quasi steady-state specific emission rates of Group 1 target VOCs for large-scale Experiment V-3.

Sample ID	Specific Emission Rate, $\mu\text{g m}^{-2} \text{ h}^{-1}$							
	n-C10	n-C12	n-C13	n-C14	Toluene	Xylenes	Styrene	1,2,4-TMB
1-h	391	345	800	354	759	45	18	127
3-h	71	67	208	98	128	12	8	35
6-h	50	39	113	54	81	8	7	25
24-h	29	19	59	26	51	5	5	15
48-h	33	24	68	33	46	5	4	18
72-h	30	23	65	32	39	4	3	17
96-h	25	19	60	28	36	4	3	14
120-h	27	20	62	32	37	4	3	15
144-h	29	22	65	33	39	4	3	17
168-h	29	21	62	32	35	5	3	17
192-h	28	23	68	34	34	5	3	17
216-h	35	25	72	37	41	5	3	18
240-h	31	25	75	40	45	5	3	19
336-h	25	22	67	35	37	4	2	16

Table J-24. Quasi steady-state specific emission rates of Group 2 target VOCs for large-scale Experiment V-3.

Sample ID	C-hexone	Benzald	THF	Specific Emission Rate, $\mu\text{g m}^{-2} \text{h}^{-1}$			TXIB	Butisothio	Benzothiaz
				Octanol	Benz alc	Phenol			
1-h	12,100	45	29,800	27	45	191	18	9	45
3-h	1,040	16	2,560	8	24	86	24	8	20
6-h	719	13	1,480	8	15	57	24	8	13
24-h	106	9	153	7	15	52	21	7	15
48-h	55	11	82	8	21	71	28	6	21
72-h	37	10	52	8	22	72	26	6	20
96-h	25	9	36	7	19	69	26	5	20
120-h	24	8	35	8	22	74	26	5	21
144-h	22	9	31	9	23	73	35	5	21
168-h	22	10	33	9	22	74	35	5	20
192-h	18	9	27	9	22	78	37	4	21
216-h	20	11	28	9	22	80	43	5	20
240-h	18	9	26	9	23	80	45	4	20
336-h	13	8	16	7	17	72	37	2	17

Table J-25. Quasi steady-state specific emission rates of TVOC for large-scale Experiments V-1 through V-4.

Sample ID	Specific Emission Rate, $\mu\text{g m}^{-2} \text{h}^{-1}$			
	Exp V-1*	Exp V-4	Exp V-2	Exp V-3
1-h	34,500	42,300	23,300	28,600
3-h	4,620	3,480	8,120	2,680
6-h	5,130	2,670	5,560	2,390
24-h	2,200	1,400	4,190	1,170
48-h	1,700	1,090	3,550	1,180
72-h	1,380	1,080	4,240	1,020
96-h	1,400	1,350	967	980
120-h	1,530	1,330	1,230	980
144-h	1,590	1,310	1,060	1,060
168-h	---	1,160	1,000	1,060
192-h	---	1,120	964	1,070
216-h	---	1,210	1,010	1,230
240-h	---	1,190	1,090	1,250
336-h	---	955	1,130	1,060

*Data subsequent to 144-h elapsed time were invalid.

Table J-26. Quasi steady-state specific emission rates of formaldehyde for large-scale Experiments V-1 through V-4.

Sample ID	Specific Emission Rate, $\mu\text{g m}^{-2} \text{h}^{-1}$			
	Exp V-1*	Exp V-4	Exp V-2	Exp V-3
1-h	24.5	23.5	<25.0	17.2
3-h	12.5	8.2	15.7	14.1
6-h	14.7	7.5	13.7	9.9
24-h	3.6	<2.5	<10.0	3.3
48-h	2.8	<2.5	<10.0	<2.5
72-h	<2.5	<2.5	<10.0	4.7
96-h	<2.5	<2.5	3.7	4.3
120-h	<2.5	2.9	6.0	3.4
144-h	<2.5	<2.5	7.5	3.7
168-h	---	<2.5	7.2	4.2
192-h	---	<2.5	8.3	5.4
216-h	---	3.9	11.3	6.9
240-h	---	<2.5	14.6	6.6
336-h	---	<2.5	9.3	8.1

*Data subsequent to 144-h elapsed time were invalid.

Table J-27. Quasi steady-state specific emission rates of acetaldehyde for large-scale Experiments V-1 through V-4.

Sample ID	Specific Emission Rate, $\mu\text{g m}^{-2} \text{h}^{-1}$			
	Exp V-1*	Exp V-4	Exp V-2	Exp V-3
1-h	6.9	<10.0	<25.0	<10.0
3-h	7.8	<2.5	<10.0	3.4
6-h	15.9	5.5	<10.0	5.1
24-h	8.6	4.3	<10.0	<2.5
48-h	7.1	<2.5	<10.0	2.9
72-h	5.4	<2.5	<10.0	3.7
96-h	4.2	<2.5	4.8	5.4
120-h	2.9	2.8	<2.5	5.0
144-h	<2.5	<2.5	<2.5	4.2
168-h	---	<2.5	2.8	5.1
192-h	---	2.5	<2.5	5.6
216-h	---	4.0	<2.5	7.0
240-h	---	<2.5	4.7	4.8
336-h	---	<2.5	<2.5	5.8

*Data subsequent to 144-h elapsed time were invalid.

Table J-28. Cumulative masses (milligrams) of target compounds and TVOC emitted over 0 - 336 hours in large-scale Experiments V-1 through V-4.

Compound	Exp V-1*	Cumulative Mass, mg		Exp V-3
		Exp V-4	Exp V-2	
Alkane Hydrocarbons				
n-Decane	84	131	138	113
n-Dodecane	55	97	112	87
n-Tridecane	147	264	337	257
n-Tetradecane	73	132	178	129
Aromatic Hydrocarbons				
Toluene	492	227	179	162
m-,p-Xylene	11	18	21	17
Styrene	13	15	20	12
1,2,4-Trimethylbenzene	37	68	81	63
Carbonyl Compounds				
Formaldehyde	<5	<7	<30	19
Acetaldehyde	9	<7	<11	<17
Cyclohexanone	591	576	370	454
Benzaldehyde	19	37	52	34
Other Oxidized Cmpds.				
Tetrahydrofuran	1,010	1,040	298	987
1-Octanol	17	30	45	29
Benzyl alcohol	46	83	144	72
Phenol	142	339	503	257
2,2,4-Trimethyl-1,3-pentanediol diisobutyrate	54	127	216	119
Miscellaneous Cmpds.				
tert-Butylisothiocyanate	8	14	16	16
Benzothiazole	52	91	160	68
SigmaVOC	2,850	3,280	2,860	2,880
TVOC	3,580	5,200	6,970	4,630

*Cumulative masses emitted over 0 - 144 hours only.

Table J-29. Cumulative exposures (ppb-hour) to target compounds during the first 48 hours of large-scale Experiments V-1 through V-4. Estimates assume 20 hours of occupancy per day.

Compound	Cumulative Exposure, ppb-hour			
	Exp V-1	Exp V-4	Exp V-2	Exp V-3
Alkane Hydrocarbons				
n-Decane	338	264	97	224
n-Dodecane	198	172	72	138
n-Tridecane	473	425	219	375
n-Tetradecane	228	191	111	162
Aromatic Hydrocarbons				
Toluene	5,430	866	196	579
m-,p-Xylene	74	49	20	47
Styrene	100	52	22	39
1,2,4-Trimethylbenzene	193	167	70	132
Carbonyl Compounds				
Formaldehyde	468	251	170	347
Acetaldehyde	381	200	123	193
Cyclohexanone	4,170	3,320	992	3,070
Benzaldehyde	109	102	58	84
Other Oxidized Cmpds.				
Tetrahydrofuran	9,440	7,320	1,400	8,940
1-Octanol	78	60	37	48
Benzyl alcohol	227	186	171	127
Phenol	801	931	727	510
2,2,4-Trimethyl-1,3-pentanediol diisobutyrate	101	78	89	65
Miscellaneous Cmpds.				
tert-Butylisothiocyanate	55	59	17	49
Benzothiazole	204	169	154	99

Table J-30. Cumulative exposures (ppb-hour) to target compounds over 48 - 336 hours in large-scale Experiments V-1 through V-4. Estimates assume 20 hours of occupancy per day.

Compound	Cumulative Exposure, ppb-hour			
	Exp V-1*	Exp V-4	Exp V-2	Exp V-3
Alkane Hydrocarbons				
n-Decane	509	1,050	974	1,020
n-Dodecane	277	665	631	657
n-Tridecane	691	1,720	1,620	1,820
n-Tetradecane	312	813	782	868
Aromatic Hydrocarbons				
Toluene	2,550	2,830	2,080	2,190
m-,p-Xylene	87	200	192	204
Styrene	105	169	179	142
1,2,4-Trimethylbenzene	277	678	664	705
Carbonyl Compounds				
Formaldehyde	<157	<470	1,310	869
Acetaldehyde	155	<320	<320	553
Cyclohexanone	703	1,160	1,040	1,120
Benzaldehyde	171	431	436	432
Other Oxidized Cmpds.				
Tetrahydrofuran	1,170	2,010	1,400	2,390
1-Octanol	127	296	329	312
Benzyl alcohol	443	1,010	1,060	965
Phenol	1,540	4,660	3,910	3,960
2,2,4-Trimethyl-1,3-pentanediol diisobutyrate	209	630	609	623
Miscellaneous Cmpds.				
<i>tert</i> -Butylisothiocyanate	58	124	116	181
Benzothiazole	407	894	903	730

*Cumulative exposures over 48 - 144 hours only.

APPENDIX K

EXPOSURE REDUCTION AND LONG-TERM EXPERIMENTS WITH COMBINED ASSEMBLIES

Appendix K presents the analytical data for the two large-scale exposure reduction experiments with the combined source assemblies. The experiments were conducted in 25.5 m³ chamber compartments over a period of 336 hours. One of the experiments was extended for a period of 2,016 hours. Paints LPS2, FLP3 and SGLP3 were applied to gypsum board and plywood panels with a total surface area of 16 m². Two-thirds of the 10.4-m² floor area was carpeted with Carpet CP4 and Carpet Cushion CC4. The remaining floor area was covered with Sheet Vinyl SV5. The concentrations of selected compounds and TVOC were measured throughout the experiments. Specific emission rates of these components were calculated. Cumulative mass emissions and cumulative exposures were estimated.

List of Tables

	<u>Page</u>
Table K-01. Summary of environmental parameters for large-scale Experiments A-1 and A-2	429
Table K-02. Source materials and quantities used in large-scale Experiments A-1 and A-2	430
Table K-03. VOCs emitted by combined source materials in large-scale Experiment A-2.....	431
Table K-04. Target compounds quantified in large-scale Experiments A-1 and A-2.....	434
Table K-05. Concentrations of Group 1 target VOCs for large-scale Experiment A-2.	435
Table K-06. Concentrations of Group 2 target VOCs for large-scale Experiment A-2.	436
Table K-07. Concentrations of Group 1 target VOCs for large-scale Experiment A-1.	437
Table K-08. Concentrations of Group 2 target VOCs for large-scale Experiment A-1.	438
Table K-09. Concentrations of SigmaVOC _P and TVOC _R for large-scale Experiments A-1 and A-2.....	439
Table K-10. Concentrations of formaldehyde and acetaldehyde for large-scale Experiments A-1 and A-2.....	440
Table K-11. Quasi steady-state specific emission rates of Group 1 target VOCs for large-scale Experiment A-2	441
Table K-12. Quasi steady-state specific emission rates of Group 2 target VOCs for large-scale Experiment A-2.	442
Table K-13. Quasi steady-state specific emission rates of Group 1 target VOCs for large-scale Experiment A-1	443
Table K-14. Quasi steady-state specific emission rates of Group 2 target VOCs for large-scale Experiment A-1	444
Table K-15. Quasi steady-state specific emission rates of TVOC _R for large-scale Experiments A-1 and A-2	445
Table K-16. Cumulative masses of target VOCs and TVOC _R in large-scale Experiments A-1 and A-2	446
Table K-17. Cumulative exposures to target VOCs over 0 - 48 and 48 - 336 hours in large-scale Experiment A-2	447
Table K-18. Cumulative exposures to target VOCs over 96 - 336 hours in large-scale Experiments A-1 and A-2	448
Table K-19. Summary of environmental parameters over 336 - 2,016 hours in large-scale Experiment A-2.	449
Table K-20. Concentrations of Group 1 target VOCs over 336 - 2,016 hours in large-scale Experiment A-2.	450
Table K-21. Concentrations of Group 2 target VOCs over 336 - 2,016 hours in large-scale Experiment A-2.	451
Table K-22. Concentrations of SigmaVOC _P and TVOC _R over 336 - 2,016 hours in large-scale Experiment A-2.	452
Table K-23. Quasi steady-state specific emission rates of Group 1 target VOCs over 336 - 2,016 hours in large-scale Experiment A-2.....	453

List of Tables, Continued

	<u>Page</u>
Table K-24. Quasi steady-state specific emission rates of Group 2 target VOCs over 336 - 2,016 hours in large-scale Experiment A-2.....	454
Table K-25. Quasi steady-state specific emission rates of TVOC _R over 336 - 2,016 hours in large-scale Experiment A-2.....	455
Table K-26. Cumulative masses of target VOCs and TVOC _R emitted over 336 - 2,016 hours in large-scale Experiment A-2.....	456
Table K-27. Cumulative exposures to target VOCs over 336 - 2,016 hours in large-scale Experiment A-2	457

Table K-01. Summary of environmental parameters for large-scale Experiments A-1 and A-2 with combined source materials.

Parameter	Experiment	
	A-2	A-1
Paint application date	02/09/98	01/20/98
Treatment	Add ventilation	Add vent. & heating
Paint drying & flooring install., -72 - 0 h		
Ventilation rate (h^{-1}), Avg. \pm 1 std. dev. (Range)	1.97 ± 0.01 1.94 - 2.00	1.91 ± 0.01 1.88 - 1.94
Temperature ($^{\circ}\text{C}$), Avg. \pm 1 std. dev. (Range)	22.1 ± 0.3 21.4 - 22.8	22.3 ± 0.3 21.2 - 22.9
Relative Humidity (%), Avg. \pm 1 std. dev. (Range)	46 ± 1 43 - 49	43 ± 2 40 - 49
Post flooring installation, 0 - 6 h		
Ventilation rate (h^{-1}), Avg. \pm 1 std. dev. (Range)	1.96 ± 0.01 1.93 - 2.00	1.91 ± 0.01 1.89 - 1.93
Temperature ($^{\circ}\text{C}$), Avg. \pm 1 std. dev. (Range)	23.1 ± 0.3 22.7 - 24.1	23.5 ± 0.2 21.2 - 22.9
Relative Humidity (%), Avg. \pm 1 std. dev. (Range)	47 ± 2 44 - 54	44 ± 1 41 - 49
Heating period, 12 - 72 h		
Ventilation rate (h^{-1}), Avg. \pm 1 std. dev. (Range)	1.96 ± 0.01 1.93 - 2.00	1.91 ± 0.01 1.88 - 1.94
Temperature ($^{\circ}\text{C}$), Avg. \pm 1 std. dev. (Range)	22.4 ± 0.2 21.9 - 23.1	32.7 ± 0.6 31.8 - 33.8
Relative Humidity (%), Avg. \pm 1 std. dev. (Range)	47 ± 2 44 - 50	28 ± 1 24 - 30
Remaining period, 80 - 336 h		
Ventilation rate (h^{-1}), Avg. \pm 1 std. dev. (Range)	0.50 ± 0.01 0.49 - 0.51	0.48 ± 0.01 0.47 - 0.49
Temperature ($^{\circ}\text{C}$), Avg. \pm 1 std. dev. (Range)	21.8 ± 0.3 21.0 - 22.4	22.5 ± 0.8 21.7 - 27.4
Relative Humidity (%), Avg. \pm 1 std. dev. (Range)	44 ± 1 41 - 47	46 ± 3 35 - 50

Table K-02. Source materials and quantities used in large-scale Experiments A-1 and A-2. See Appendices C, D and E (Tables C-01, D-01 and E01) for material descriptions.

Material Description	Material ID	Unit of Measure	Quantity	
			Exp A-2	Exp A-1
Latex Paints				
Primer Sealer	LPS2	g	2,150	1,910
Flat	FLP3	g	1,900	1,660
Semi-Gloss	SGLP3	g	90	91
Vinyl Flooring Materials				
Particle board underlayment	UL	m ²	3.48	3.48
Residential sheet vinyl	SV5	m ²	3.48	3.48
Rubber cove base, 4" wide	CB	m	5.33	5.33
Sheet flooring adhesive	SFA	g	910	800
Cove base adhesive	CBA	g	222	174
Seam sealer	SS	mL	5	5
Carpet Materials				
Commercial olefin carpet	CP4	m ²	6.97	6.97
Rebonded urethane carpet cushion	CC4	m ²	5.94	5.94
Thermal seam tape	ST	m	2.29	3.05

Table K-03. VOCs emitted by combined source materials in large-scale Experiment A-2 at 24- and 240-hours elapsed times.

COMPOUND	Code*	RT (min)	24-h ET	240-h ET	Match Quality
Alkane Hydrocarbons					
C9 Branched alkane HC		13.7		+	Probable
C9 Branched alkane HC		14.1		+	Probable
n-Nonane	B	15.2	+	+	Confirmed
C10 Branched alkane HC		16.6		+	Probable
C10 Branched alkane HC		17.7	+	+	Probable
C10 Branched alkane HC		17.8		+	Probable
C10 Branched alkane HC		18.1	+	+	Probable
n-Decane	A,Q	19.1	+	+	Confirmed
C11 Branched alkane HC	B	20.0	+	+	Probable
C11 Branched alkane HC		21.2	+	+	Probable
C11 Branched alkane HC		21.4	+	+	Probable
n-Undecane		22.8	+	+	Confirmed
C12 Branched alkane HC		23.0	+	+	Probable
n-Dodecane	B	26.0	+	+	Confirmed
C13 Branched alkane HC		28.5	+	+	Probable
n-Tridecane	A,B,Q	29.3	+	+	Confirmed
C14 Branched alkane HC		29.9	+	+	Probable
n-Tetradecane	B	32.2	+	+	Confirmed
C15 Branched alkane HC		34.6	+	+	Probable
Aromatic Hydrocarbons					
Toluene	T,B,Q	11.7	+	+	Confirmed
m-,p-Xylene	T	16.1	+	+	Confirmed
o-Xylene	T	17.3	+	+	Confirmed
Styrene	T,Q	17.6	+	+	Confirmed
Isopropylbenzene		18.2	+	+	Confirmed
Propylbenzene	B	19.4	+	+	Confirmed
Ethyltoluene isomer	B	19.7	+	+	Probable
2-Ethyltoluene		20.6	+	+	Confirmed
1,2,4-Trimethylbenzene	T,B,Q	21.2	+	+	Confirmed
C4 Alkylbenzene		23.0	+	+	Probable
4-Phenylcyclohexene	Q	33.0	+	+	Confirmed
C2 Tetrahydronaphthalene		32.6	+	+	Probable
(1-Butoxyhexyl)benzene		37.1	+	+	Probable
(1-Methylnonyl)benzene		39.0	+	+	Probable
(1-Phenylhexyl)benzene		39.4	+	+	Probable
(1-Butylheptyl)benzene		39.5	+	+	Probable
(1-Propyloctyl)benzene		39.9	+	+	Probable
(1-Ethylononyl)benzene		40.4	+	+	Probable
(1-Methyldecyl)benzene		41.5	+	+	Probable
Other Hydrocarbons					
4-Ethenylcyclohexene		13.6	+	+	Confirmed
Propylcyclohexane		17.0		+	Confirmed
alpha-Pinene	B	17.3		+	Confirmed

Table K-03, Continued. VOCs emitted by combined source materials in large-scale Experiment A-2 at 24- and 240-hours elapsed times.

COMPOUND	Code*	RT (min)	24-h ET	240-h ET	Match Quality
Other Hydrocarbons, Con't.					
C10 Alkene or cyclic HC		18.2		+	Probable
C10 Alkene or cyclic HC		18.9	+	+	Probable
Butylcyclohexane		20.9	+	+	Confirmed
C11 Alkene HC		21.5	+	+	Probable
C11 Alkene HC		22.0	+	+	Tentative
C11 Alkene HC		22.1	+	+	Probable
C11 Alkene HC		22.4	+	+	Probable
C11 Alkene HC		22.6	+	+	Probable
C12 Alkene HC		23.0	+	+	Probable
C12 Alkene HC		23.2	+	+	Probable
C12 Alkene HC		23.9	+	+	Probable
Alkene HC		30.4	+		Tentative
Carbonyl Compounds					
Hexanal	B	14.5		+	Confirmed
Cyclohexanone	Q	19.8	+	+	Confirmed
Benzaldehyde	B	22.5	+	+	Confirmed
Nonanal	B	26.0	+	+	Confirmed
Other Oxidized Compounds					
Tetrahydrofuran	B,Q	6.2	+	+	Confirmed
Acetic acid	B	10.8	+	+	Confirmed
n-Butyl ether		15.3	+	+	Confirmed
Ethylene glycol	T,A,Q	15.6	+	+	Confirmed
Propylene glycol	Q	16.3	+		Confirmed
2-Methylpropanoic acid		16.3	+	+	Probable
Hexylene glycol		23.2	+	+	Confirmed
Benzyl alcohol	Q	26.5	+	+	Confirmed
Phenol	T,A,B,Q	26.6	+	+	Confirmed
1,1'-Oxybis-2-propanol		27.5	+	+	Tentative
2-(2-Butoxyethoxy)ethanol	T,Q	29.8	+	+	Confirmed
2,2,4-Trimethyl-1,3-pentanediol monoisobutyrate (Texanol 1)	A,Q	35.2	+	+	Confirmed
2,2,4-Trimethyl-1,3-pentanediol monoisobutyrate (Texanol 3)	A,Q	35.7	+	+	Confirmed
1-Dodecanol		37.1		+	Confirmed
2,6-Di- <i>tert</i> -butyl-4-methylphenol (butylated hydroxytoluene)	Q	37.7	+	+	Confirmed
2,2,4-Trimethyl-1,3-pentanediol diisobutyrate (TXIB)	A,Q	40.2	+	+	Confirmed
Nitrogen-Containing Compounds					
2,2'-Azobisisobutyronitrile	Q	27.2	+	+	Confirmed
2-Methyleneglucaronitrile		31.1	+	+	Confirmed

Table K-03, Continued. VOCs emitted by combined source materials in large-scale Experiment A-2 at 24- and 240-hours elapsed times.

COMPOUND	Code*	RT (min)	24-h ET	240-h ET	Match Quality
Miscellaneous Compounds					
Benzothiazole	Q	31.6	+	+	Confirmed
Unidentified Compounds					
Unidentified glycol ether		23.7	+	+	Unident.
Unidentified glycol ether		26.4	+	+	Unident.
Unidentified glycol ether		28.8	+	+	Unident.
Unidentified compound		36.6	+	+	Unident.

*T = Toxic air contaminant; A = Abundant compound; B = Component of chamber background;
 Q = Quantified target compound.

Table K-04. Target compounds quantified in large-scale Experiments A-1 and A-2.

Compound	Group	Table Abbrev.	Dominant Source(s)	Source Area* (m ²)
Alkane Hydrocarbons				
n-Decane	1	n-C10	SV5,CBA	3.48
n-Tridecane	1	n-C13	SV5,CB	3.48
Aromatic Hydrocarbons				
Toluene	1		SV5,CB,SFA,CBA	3.48
Styrene	2		CP4,CB,CBA	6.97
1,2,4-Trimethylbenzene	1	1,2,4-TMB	SV5	3.48
4-Phenylcyclohexene	2	4-PCH	CP4	6.97
Carbonyl Compounds				
Formaldehyde	Ald		No dominant src.	10.4
Acetaldehyde	Ald		No dominant src.	10.4
Cyclohexanone	1	C-hexone	CB,SS	3.48
Other Oxidized Cmpds.				
Tetrahydrofuran	1	THF	SS	3.48
Ethylene glycol	2	EG	LPS2,FLP3	16.0
Propylene glycol	2	PG	LPS2,SGLP3	16.0
Benzyl alcohol	1	Benz alc	SV5	3.48
Phenol	1		SV5	3.48
2-(2-Butoxyethoxy)ethanol	2	DEGBE	LPS2,SGLP3	16.0
2,2,4-Trimethyl-1,3-pentane-diol monoisobutyrate (combined isomers)	2	Texanol	LPS2,FLP3,SGLP3	16.0
2,2,4-Trimethyl-1,3-pentanediol diisobutyrate	1	TXIB	SV5	3.48
2,6-Di- <i>tert</i> -butyl-4-methylphenol	2	BHT	CC4	6.97
Miscellaneous Cmpds.				
2,2'-Azobisisobutyronitrile	2	AIBN	CC4	6.97
Benzothiazole	1	Benzothia	CB	3.48

*Area used for calculation of specific emission rates.

Table K-05. Concentrations of Group 1 target VOCs for large-scale Experiment A-2.

Sample ID	Chamber Concentration, $\mu\text{g m}^{-3}$									
	n-C10	n-C13	Toluene	1,2,4-TMB	C-hexone	THF	Benz alc	Phenol	TXIB	Benzothia
Avg. Inlet	<1	<1	<1	<1	<1	2	<1	<1	<1	<1
Backgrnd.	4	<1	2	1	<1	2	<1	3	0	<1
Minus 3 h	<1	<1	<1	<1	<1	2	<1	2	9	<1
1-h	138	90	140	21	2,180	4,760	11	58	30	11
3-h	42	39	48	7	476	1,070	7	42	19	10
6-h	33	27	30	5	181	269	7	36	17	9
24-h	13	14	9	3	38	20	5	31	13	8
48-h	8	11	6	2	17	8	4	29	13	7
72-h	7	8	4	1	9	5	4	25	10	6
96-h	22	16	20	4	18	11	5	30	13	8
120-h	22	18	18	5	17	9	6	33	15	9
144-h	22	19	18	5	16	8	6	34	15	9
168-h	23	18	17	5	13	7	6	31	14	9
192-h	22	18	16	5	11	5	5	32	14	9
216-h	21	18	16	5	10	5	5	30	14	9
240-h	21	18	15	5	9	5	5	30	14	9
336-h	18	16	13	4	6	3	4	27	13	8

Table K-06. Concentrations of Group 2 target VOCs for large-scale Experiment A-2.

Sample ID	Styrene	4-PCH	BHT	Chamber Concentration, $\mu\text{g m}^{-3}$			PG	DEGBE	Texanol
				AIBN	EG				
Avg. Inlet	<1	<1	<1	<1	<32		<12	<1	<2
Background	<1	<1	<1	<1	<32		<12	<1	<2
Minus 3 h	<1	<1	<1	<1	567		36	21	2,020
1-h	23	7	7	18	617		61	26	2,580
3-h	11	5	4	11	392		<35	18	2,020
6-h	9	5	3	10	305		<35	14	2,010
24-h	3	4	2	9	203		<35	10	1,140
48-h	2	4	2	8	214		<29	7	1,550
72-h	1	3	2	6	161		<29	5	1,120
96-h	2	5	4	15	172		<29	6	1,790
120-h	2	6	5	16	182		<23	7	1,480
144-h	2	6	5	16	199		<23	6	1,550
168-h	2	6	6	14	109		<23	6	1,640
192-h	2	5	6	13	196		<17	5	1,550
216-h	1	5	7	11	184		<17	5	1,700
240-h	1	5	7	10	167		<17	4	1,510
336-h	1	4	8	8	135		<14	3	1,110

Table K-07. Concentrations of Group 1 target VOCs for large-scale Experiment A-1.

Sample ID	Chamber Concentration, $\mu\text{g m}^{-3}$									
	n-C10	n-C13	Toluene	1,2,4-TMB	C-hexone	THF	Benz alc	Phenol	TXIB	Benzothia
Avg. Inlet	<1	<1	1	<1	<1	3	<1	<1	<1	<1
Backgrnd.	<1	1	<1	<1	<1	1	<1	2	1	<1
Minus 3 h	4	3	4	<1	12	2	<1	3	9	<1
1-h	130	107	125	23	1,520	3,270	14	75	27	11
3-h	46	44	59	8	388	1,080	8	50	21	7
6-h	33	30	43	6	147	285	7	43	18	7
12-h	36	45	23	8	125	160	10	81	32	10
24-h	25	39	14	7	55	61	12	82	41	10
48-h	19	28	10	5	23	20	9	57	33	7
72-h	16	25	9	4	15	15	8	50	28	6
78-h	39	34	26	10	36	34	8	47	25	6
96-h	26	21	19	6	21	23	5	30	17	5
120-h	27	23	18	6	19	20	6	33	16	6
144-h	24	21	16	5	16	17	6	31	14	5
168-h	21	18	14	5	13	14	5	28	12	5
192-h	23	22	15	6	13	16	6	32	14	5
216-h	23	21	14	6	13	14	5	31	14	5
240-h	22	21	14	6	12	13	5	30	13	5
336-h	20	20	12	6	11	10	5	30	13	5

Table K-08. Concentrations of Group 2 target VOCs for large-scale Experiment A-1.

Sample ID	Styrene	4-PCH	BHT	Chamber Concentration, $\mu\text{g m}^{-3}$			PG	DEGBE	Texanol
				AIBN	EG				
Avg. Inlet	<1	<1	<1	<1	<32		<12	<1	<2
Background	<1	<1	1	<1	<32		<12	<1	<2
Minus 3 h	<1	<1	<1	<1	651		88	25	2,020
1-h	11	9	11	21	695		88	28	2,400
3-h	5	6	5	12	337		<35	15	1,960
6-h	4	5	4	10	242		<35	17	1,380
12-h	5	15	6	16	306		<35	29	3,730
24-h	2	15	6	18	311		<35	25	4,560
48-h	1	10	6	13	251		<29	10	2,430
72-h	1	6	5	10	146		<23	6	1,600
78-h	2	7	6	15	181		<23	5	1,630
96-h	1	5	5	12	133		<23	3	934
120-h	1	5	6	14	146		<17	4	1,070
144-h	1	4	6	12	200		<17	4	848
168-h	1	4	6	9	161		<17	3	900
192-h	1	4	7	10	172		<17	4	1,040
216-h	1	4	8	9	138		<17	3	864
240-h	1	4	8	8	203		<17	7	902
336-h	1	3	10	6	159		<12	3	702

Table K-09. Concentrations of SigmaVOC_P (i.e., sum of four target VOCs for paint) and TVOC_R (i.e., remainder of chromatographic response) for large-scale Experiments A-1 and A-2.

Sample ID	Chamber Concentration, $\mu\text{g m}^{-3}$			
	SigmaVOC _P		TVOC _R	
	Exp A-2	Exp A-1	Exp A-2	Exp A-1
Avg. Inlet*	<47	<47	35 \pm 9	46 \pm 11
Background	<47	<47	85	80
Minus 3 h	2,640	2,780	329	317
1-h	3,280	3,210	5,700	4,450
3-h	2,430	2,310	1,520	1,740
6-h	2,330	1,640	1,020	1,170
12-h	---	4,060	---	1,810
24-h	1,350	4,900	615	1,590
48-h	1,770	2,690	467	1,080
72-h	1,290	1,750	398	861
78-h	---	1,820	---	1,230
96-h	1,970	1,070	781	943
120-h	1,670	1,220	761	876
144-h	1,750	1,050	800	767
168-h	1,750	1,060	749	712
192-h	1,750	1,220	695	780
216-h	1,890	1,000	665	748
240-h	1,680	1,110	690	728
336-h	1,250	864	642	730

*Average \pm 1 standard deviation.

Table K-10. Concentrations of formaldehyde and acetaldehyde for large-scale Experiments A-1 and A-2.

Sample ID	Chamber Concentration, $\mu\text{g m}^{-3}$			
	Formaldehyde		Acetaldehyde	
	Exp A-2	Exp A-1	Exp A-2	Exp A-1
Avg. Inlet*	2 ± 1	2 ± 1	2 ± 1	2 ± 1
Background	7	2	5	3
Minus 3 h	3	<1	2	2
1-h	6	1	5	5
3-h	6	1	4	3
6-h	6	2	4	3
12-h	---	1	---	3
24-h	4	1	3	2
48-h	4	1	2	2
72-h	4	2	2	2
78-h	---	2	---	2
96-h	6	2	6	2
120-h	6	2	5	2
144-h	5	2	5	1
168-h	6	2	5	2
192-h	4	2	4	1
216-h	6	2	5	1
240-h	6	3	4	<1
336-h	4	3	3	1

*Average \pm 1 standard deviation.

Table K-11. Quasi steady-state specific emission rates of Group 1 target VOCs for large-scale Experiment A-2. Source areas were taken from Table K-02.

Sample ID	Specific Emission Rate, $\mu\text{g m}^{-2} \text{ h}^{-1}$									
	n-C10	n-C13	Toluene	1,2,4-TMB	C-hexone	THF	Benz alc	Phenol	TXIB	Benzothia
Area, m ²	3.48	3.48	3.48	3.48	3.48	3.48	3.48	3.48	3.48	3.48
1-h	1,980	1,290	2,010	298	31,300	68,200	157	840	426	164
3-h	600	558	690	98	6,830	15,300	98	607	272	139
6-h	474	390	425	70	2,600	3,810	98	523	251	132
24-h	181	195	125	42	544	264	70	446	181	112
48-h	122	157	81	29	238	87	64	413	180	99
72-h	102	116	60	19	125	55	51	353	144	84
96-h	80	59	73	16	67	35	18	108	49	31
120-h	81	65	68	18	62	30	20	120	53	34
144-h	82	70	65	19	57	26	21	123	53	34
168-h	83	68	64	18	46	24	20	115	51	34
192-h	79	65	59	18	42	16	20	116	52	32
216-h	76	65	57	17	37	15	19	111	52	32
240-h	76	65	55	18	35	13	20	111	52	32
336-h	66	58	47	16	23	8	16	100	47	28

Table K-12. Quasi steady-state specific emission rates of Group 2 target VOCs for large-scale Experiment A-2. Source areas were taken from Table K-02.

Sample ID	Area, m ²	Specific Emission Rate, µg m ⁻² h ⁻¹							
		Styrene	4-PCH	BHT	AIBN	EG	PG	DEGBE	Texanol
Area, m ²		6.97	6.97	6.97	6.97	16.0	16.0	16.0	16.0
1-h		163	49	47	131	1,930	192	81	7,450
3-h		77	35	28	77	1,220	<109	56	6,320
6-h		63	35	21	73	952	<109	44	6,280
24-h		21	28	14	63	634	<109	30	3,550
48-h		12	26	12	55	667	<92	21	4,840
72-h		9	23	16	46	504	<92	16	3,510
96-h		4	9	7	27	137	<23	5	1,430
120-h		4	10	8	30	145	<19	6	1,180
144-h		4	11	9	28	159	<19	5	1,230
168-h		4	10	10	25	151	<19	4	1,310
192-h		4	10	11	24	156	<14	4	1,230
216-h		3	9	13	20	147	<14	4	1,360
240-h		3	9	13	19	133	<14	3	1,200
336-h		2	8	15	14	108	<11	2	885

Table K-13. Quasi steady-state specific emission rates of Group 1 target VOCs for large-scale Experiment A-1. Source areas were taken from Table K-02.

Sample ID	Area, m ²	n-C10	n-C13	Toluene	Specific Emission Rate, µg m ⁻² h ⁻¹						Phenol	TXIB	Benzoethia
					1,2,4-TMB	C-hexone	THF	Benz alc					
Area, m ²		3.48	3.48	3.48	3.48	3.48	3.48	3.48	3.48	3.48	3.48	3.48	
1-h		1,820	1,490	1,750	326	21,200	45,600	190	1,050	380	149		
3-h		639	611	829	109	5,430	15,000	109	707	299	95		
6-h		462	421	598	82	2,050	3,940	95	598	258	95		
12-h		498	634	317	113	1,740	2,210	136	1,130	453	136		
24-h		353	544	190	95	775	842	163	1,150	571	136		
48-h		272	396	136	68	317	255	125	804	464	102		
72-h		226	353	127	63	217	189	109	698	390	82		
78-h		137	118	93	34	127	111	30	164	89	23		
96-h		93	73	66	23	75	73	18	107	59	18		
120-h		94	80	65	22	67	65	22	118	56	20		
144-h		85	72	55	19	55	53	20	108	50	19		
168-h		75	65	51	19	46	44	18	97	44	18		
192-h		81	78	53	21	47	48	21	114	50	19		
216-h		80	74	49	20	45	41	19	108	48	19		
240-h		78	72	48	20	41	37	19	104	47	19		
336-h		70	71	41	20	38	27	19	104	48	19		

Table K-14. Quasi steady-state specific emission rates of Group 2 target VOCs for large-scale Experiment A-1. Source areas were taken from Table K-02.

Sample ID	Styrene	4-PCH	BHT	Specific Emission Rate, $\mu\text{g m}^{-2} \text{h}^{-1}$			PG	DEGBE	Texanol
				AIBN	EG				
Area, m ²	6.97	6.97	6.97	6.97	16.0	16.0	16.0	16.0	16.0
1-h	75	61	75	149	2,120	269	86	7,300	
3-h	34	41	34	81	1,050	<106	47	5,980	
6-h	27	34	27	68	736	<106	53	4,190	
12-h	34	102	45	113	931	<106	89	11,300	
24-h	14	102	41	129	946	<106	77	13,900	
48-h	6	68	40	90	763	<89	30	7,390	
72-h	5	45	36	68	445	<71	18	4,880	
78-h	3	13	11	27	138	<18	4	1,240	
96-h	2	9	9	22	102	<18	2	714	
120-h	3	9	11	24	111	<13	3	820	
144-h	2	8	11	20	153	<13	3	649	
168-h	2	7	11	16	124	<13	2	688	
192-h	2	8	13	17	131	<13	3	795	
216-h	2	7	14	16	106	<13	3	661	
240-h	2	7	15	13	156	<13	5	690	
336-h	<2	6	18	10	122	<9	2	537	

Table K-15. Quasi steady-state specific emission rates of TVOC_R (*i.e.*, remainder of chromatographic response after subtracting target VOCs for paint) for large-scale Experiments A-1 and A-2. Total floor area of 10.4 m² was used to calculate values.

Sample ID	Specific Emission Rate, $\mu\text{g m}^{-2} \text{h}^{-1}$	
	Exp A-2	Exp A-1
1-h	27,000	20,500
3-h	6,900	7,750
6-h	4,510	5,120
12-h	---	8,120
24-h	2,540	7,070
48-h	1,830	4,670
72-h	1,500	3,660
78-h	---	1,360
96-h	852	1,010
120-h	828	936
144-h	876	808
168-h	813	744
192-h	747	824
216-h	710	786
240-h	741	762
336-h	682	765

Table K-16. Cumulative masses (milligrams) of target VOCs and TVOC_R (i.e., remainder of chromatographic response after subtracting target VOCs for paint) emitted over 0 - 336 hours in large-scale Experiments A-1 and A-2.

Compound	Cumulative Mass, mg	
	Exp A-2	Exp A-1
Alkane Hydrocarbons		
n-Decane	135	173
n-Tridecane	121	196
Aromatic Hydrocarbons		
Toluene	108	117
Styrene	20	11
1,2,4-Trimethylbenzene	28	42
4-Phenylcyclohexene	32	51
Carbonyl Compounds		
Cyclohexanone	479	416
Other Oxidized Cmpds.		
Tetrahydrofuran	795	705
Ethylene glycol	1,490	1,490
Propylene glycol	<200	<180
Benzyl alcohol	37	52
Phenol	225	334
2-(2-Butoxyethoxy)ethanol	53	73
2,2,4-Trimethyl-1,3-pentanediol monoisobutyrate (Texanol)	10,800	13,400
2,2,4-Trimethyl-1,3-pentanediol diisobutyrate (TXIB)	99	165
2,6-Di- <i>tert</i> -butyl-4-methylphenol	30	45
Miscellaneous Cmpds.		
2,2'-Azobisisobutyronitrile	73	81
Benzothiazole	58	46
TVOC_R	4,630	6,960

Table K-17. Cumulative exposures (ppb-hour) to target VOCs over 0 - 48 and 48 - 336 hours in large-scale Experiment A-2. Estimates assume 20 hours of occupancy per day. Exposure ratios were calculated by dividing the 0- to 48-hour exposures by the total exposures over 0 - 336 hours.

Compound	Cumulative Exposure, ppb-hour		Exp. Ratio 0 - 48 h/ Total
	0 - 48 h	48 - 336 h	
Alkane Hydrocarbons			
n-Decane	147	793	0.16
n-Tridecane	103	523	0.16
Aromatic Hydrocarbons			
Toluene	198	933	0.18
Styrene	46	94	0.33
1,2,4-Trimethylbenzene	31	211	0.13
4-Phenylcyclohexene	26	178	0.13
Carbonyl Compounds			
Cyclohexanone	1,530	690	0.69
Other Oxidized Cmpds.			
Tetrahydrofuran	3,730	491	0.88
Ethylene glycol	3,920	16,400	0.19
Propylene glycol	<450	<1,600	---
Benzyl alcohol	49	273	0.15
Phenol	341	1,860	0.15
2-(2-Butoxyethoxy)ethanol	65	181	0.26
2,2,4-Trimethyl-1,3-pentanediol monoisobutyrate (Texanol)	6,810	39,900	0.15
2,2,4-Trimethyl-1,3-pentanediol diisobutyrate (TXIB)	49	277	0.15
2,6-Di- <i>tert</i> -butyl-4-methylphenol	11	164	0.06
Miscellaneous Cmpds.			
2,2'-Azobisisobutyronitrile	54	405	0.12
Benzothiazole	58	364	0.14

Table K-18. Cumulative exposures (ppb-hour) to target VOCs over 96 - 336 hours in large-scale Experiments A-1 and A-2. Estimates assume 20 hours of occupancy per day.

Compound	Cumulative Exposure, ppb-h	
	Exp A-2	Exp A-1
Alkane Hydrocarbons		
n-Decane	716	779
n-Tridecane	465	550
Aromatic Hydrocarbons		
Toluene	842	767
Styrene	79	46
1,2,4-Trimethylbenzene	193	233
4-Phenylcyclohexene	155	125
Carbonyl Compounds		
Cyclohexanone	560	678
Other Oxidized Cmpds.		
Tetrahydrofuran	394	973
Ethylene glycol	13,600	12,600
Propylene glycol	<1,200	<1,400
Benzyl alcohol	235	249
Phenol	1,580	1,580
2-(2-Butoxyethoxy)ethanol	145	131
2,2,4-Trimethyl-1,3-pentanediol monoisobutyrate (Texanol)	33,600	14,600
2,2,4-Trimethyl-1,3-pentanediol diisobutyrate (TXIB)	237	239
2,6-Di- <i>tert</i> -butyl-4-methylphenol	153	186
Miscellaneous Cmpds.		
2,2'-Azobisisobutyronitrile	352	268
Benzothiazole	315	195

Table K-19. Summary of environmental parameters over 336 - 2,016 hours in large-scale Experiment A-2.

Time Interval	Ventilation Rate (h⁻¹)	Temperature (°C)	Relative Humidity (%)
336 - 504 h			
Avg. \pm 1 Std. Dev.	0.50 \pm 0.01	21.9 \pm 0.3	44 \pm 3
Range	0.50 - 0.51	21.0 - 22.6	38 - 48
504 - 672 h			
Avg. \pm 1 Std. Dev.	0.50 \pm 0.01	22.0 \pm 0.7	43 \pm 3
Range	0.49 - 0.51	20.9 - 24.5	39 - 49
672 - 840 h			
Avg. \pm 1 Std. Dev.	0.50 \pm 0.01	22.6 \pm 0.7	50 \pm 1
Range	0.49 - 0.50	21.5 - 24.5	47 - 52
840 - 1,008 h			
Avg. \pm 1 Std. Dev.	0.50 \pm 0.01	22.5 \pm 0.5	51 \pm 2
Range	0.49 - 0.50	21.6 - 24.4	48 - 56
1,008 - 1,176 h			
Avg. \pm 1 Std. Dev.	0.50 \pm 0.01	22.0 \pm 0.4	44 \pm 2
Range	0.48 - 0.50	21.2 - 23.3	40 - 48
1,176 - 1,344 h			
Avg. \pm 1 Std. Dev.	0.50 \pm 0.01	22.0 \pm 0.2	44 \pm 1
Range	0.49 - 0.50	21.3 - 22.5	42 - 46
1,344 - 1,512 h			
Avg. \pm 1 Std. Dev.	0.50 \pm 0.01	22.0 \pm 0.4	43 \pm 2
Range	0.49 - 0.50	21.2 - 23.5	40 - 47
1,512 - 1,680 h			
Avg. \pm 1 Std. Dev.	0.50 \pm 0.01	23.0 \pm 1.0	47 \pm 3
Range	0.49 - 0.50	21.5 - 25.4	42 - 53
1,680 - 1,848 h			
Avg. \pm 1 Std. Dev.	0.50 \pm 0.01	22.9 \pm 1.0	49 \pm 2
Range	0.49 - 0.50	21.5 - 25.3	45 - 53
1,848 - 2,016 h			
Avg. \pm 1 Std. Dev.	0.49 \pm 0.01	22.6 \pm 0.6	51 \pm 1
Range	0.49 - 0.50	21.8 - 24.8	48 - 54

Table K-20. Concentrations of Group 1 target VOCs over 336 - 2,016 hours in large-scale Experiment A-2.

Sample ID	n-C10	n-C13	Toluene	Chamber Concentration, $\mu\text{g m}^{-3}$				Benz alc	Phenol	TXIB	Benzothia
				1,2,4-TMB	C-hexone	THF	Benz m-3				
Avg. Inlet	<1	<1	<1	<1	<1	2	<1	<1	<1	<1	<1
336-h	18	16	13	4	6	3	4	4	27	13	8
504-h	17	15	11	4	5	2	4	4	25	12	6
672-h	20	23	12	5	6	3	6	6	30	16	6
840-h	17	20	9	4	5	2	5	5	27	15	5
1,008-h	16	18	8	4	4	2	4	4	24	14	4
1,176-h	18	22	7	4	4	2	3	3	24	15	5
1,344-h	16	21	7	4	4	1	3	3	21	14	4
1,512-h	15	21	6	4	4	1	3	3	20	14	4
1,680-h	15	19	6	4	4	1	3	3	21	14	3
1,848-h	14	20	5	4	4	1	3	3	21	15	4
2,016-h	11	17	4	3	3	1	2	2	17	13	3

Table K-21. Concentrations of Group 2 target VOCs over 336 - 2,016 hours in large-scale Experiment A-2.

Sample ID	Styrene	4-PCH	BHT	Chamber Concentration, $\mu\text{g m}^{-3}$			PG	DEGBE	Texanol
				AIBN	EG				
Avg. Inlet	<1	<1	<1	<1	<32		<12	<1	<2
336-h	1	4	8	8	135		<14	3	1,110
504-h	1	4	10	5	108		<14	2	825
672-h	1	4	12	4	178		<14	3	1,050
840-h	1	3	12	2	146		<14	2	813
1,008-h	<1	3	11	1	131		<14	2	625
1,176-h	<1	3	13	1	122		<14	2	605
1,344-h	<1	2	15	1	111		<14	1	438
1,512-h	<1	2	14	1	92		<14	1	498
1,680-h	<1	2	13	1	73		<14	1	385
1,848-h	<1	2	15	<1	54		<14	1	350
2,016-h	<1	2	13	<1	98		<14	1	294

Table K-22. Concentrations of SigmaVOC_P (i.e., sum of four target VOCs for paint) and TVOC_R (i.e., remainder of chromatographic response) over 336 - 2,016 hours in large-scale Experiment A-2.

Sample ID	Chamber Concentration, $\mu\text{g m}^{-3}$	
	SigmaVOC _P	TVOC _R
Avg. Inlet*	<47	31 \pm 11
336-h	1,250	642
504-h	936	580
672-h	1,230	768
840-h	962	596
1,008-h	758	528
1,176-h	730	645
1,344-h	550	560
1,512-h	591	532
1,680-h	459	536
1,848-h	404	579
2,016-h	393	479

*Average \pm 1 standard deviation.

Table K-23. Quasi steady-state specific emission rates of Group 1 target VOCs over 336 - 2,016 hours in large-scale Experiment A-2. Source areas were taken from Table K-02.

Sample ID	Area, m ²	n-C10	n-C13	Toluene	Specific Emission Rate, µg m ⁻² h ⁻¹							Phenol	TXIB	Benzoethia
					1,2,4-TMB	C-hexone	THF	Benz alc						
		3.48	3.48	3.48	3.48	3.48	3.48	3.48	3.48	3.48	3.48	3.48	3.48	
336-h		66	58	47	16	23	4	16	100	47	28			
504-h		60	56	39	15	17	<4	14	90	44	24			
672-h		75	84	44	19	23	<4	20	111	59	24			
840-h		62	72	33	16	17	<4	17	98	54	20			
1,008-h		58	67	28	14	16	<4	13	88	50	16			
1,176-h		66	82	27	15	15	<4	12	89	56	17			
1,344-h		59	75	25	14	14	<4	11	78	50	15			
1,512-h		56	76	22	14	13	<4	10	73	50	13			
1,680-h		54	71	21	13	13	<4	9	76	52	12			
1,848-h		52	74	20	14	13	<4	10	78	55	13			
2,016-h		40	62	16	12	10	<4	8	63	47	11			

Table K-24. Quasi steady-state specific emission rates of Group 2 target VOCs over 336 - 2,016 hours in large-scale Experiment A-2. Source areas were taken from Table K-02.

Sample ID	Area, m ²	Specific Emission Rate, $\mu\text{g m}^{-2} \text{h}^{-1}$							
		Styrene	4-PCH	BHT	AIBN	EG	PG	DEGBE	Texanol
		6.97	6.97	6.97	6.97	16.0	16.0	16.0	16.0
336-h		2	8	15	14	108	<11	2	885
504-h		1	7	18	8	86	<11	2	658
672-h		1	8	22	7	142	<11	2	836
840-h		1	6	22	4	117	<11	2	648
1,008-h		<1	5	21	3	105	<11	2	498
1,176-h		<1	5	25	2	98	<11	1	482
1,344-h		<1	4	27	1	89	<11	1	349
1,512-h		<1	4	25	1	73	<11	1	397
1,680-h		<1	4	24	1	58	<11	1	307
1,848-h		<1	4	27	<1	43	<11	1	279
2,016-h		<1	3	25	<1	78	<11	1	234

Table K-25. Quasi steady-state specific emission rates of TVOC_R (*i.e.*, remainder of chromatographic response after subtracting target VOCs for paint) over 336 - 2,016 hours in large-scale Experiment A-2. Total floor area of 10.4 m² was used to calculate values.

Sample ID	Specific Emission Rate $\mu\text{g m}^{-2} \text{ h}^{-1}$
336-h	682
504-h	607
672-h	838
840-h	626
1,008-h	543
1,176-h	687
1,344-h	582
1,512-h	548
1,680-h	553
1,848-h	606
2,016-h	483

Table K-26. Cumulative masses (milligrams) of target VOCs and TVOC_R (i.e., remainder of chromatographic response after subtracting target VOCs for paint) emitted over 336 - 2,016 hours in large-scale Experiment A-2.

Compound	Cumulative Mass mg
Alkane Hydrocarbons	
n-Decane	348
n-Tridecane	420
Aromatic Hydrocarbons	
Toluene	169
Styrene	<10
1,2,4-Trimethylbenzene	86
4-Phenylcyclohexene	61
Carbonyl Compounds	
Cyclohexanone	92
Other Oxidized Cmpds.	
Tetrahydrofuran	<23
Ethylene glycol	2,430
Propylene glycol	<300
Benzyl alcohol	75
Phenol	505
2-(2-Butoxyethoxy)ethanol	38
2,2,4-Trimethyl-1,3-pentanediol monoisobutyrate (Texanol)	13,500
2,2,4-Trimethyl-1,3-pentanediol diisobutyrate (TXIB)	302
2,6-Di- <i>tert</i> -butyl-4-methylphenol	270
Miscellaneous Cmpds.	
2,2'-Azobisisobutyronitrile	40
Benzothiazole	101
TVOC_R	10,800

Table K-27. Cumulative exposures (ppb-hour) to target VOCs over 336 - 2,016 hours in large-scale Experiment A-2. Estimates assume 20 hours of occupancy per day.

Compound	Cumulative Exposure ppb-hour
Alkane Hydrocarbons	
n-Decane	3,910
n-Tridecane	3,650
Aromatic Hydrocarbons	
Toluene	2,940
Styrene	<100
1,2,4-Trimethylbenzene	1,150
4-Phenylcyclohexene	618
Carbonyl Compounds	
Cyclohexanone	1,500
Other Oxidized Cmpds.	
Tetrahydrofuran	834
Ethylene glycol	62,600
Propylene glycol	<6,300
Benzyl alcohol	1,110
Phenol	8,580
2-(2-Butoxyethoxy)ethanol	378
2,2,4-Trimethyl-1,3-pentanediol monoisobutyrate (Texanol)	99,700
2,2,4-Trimethyl-1,3-pentanediol diisobutyrate (TXIB)	1,690
2,6-Di- <i>tert</i> -butyl-4-methylphenol	2,110
Miscellaneous Cmpds.	
2,2'-Azobisisobutyronitrile	394
Benzothiazole	1,200

